THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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RUSSIAN AFFAIRS.

So difficult is it to discriminate between fact and fiction with regard to the internal affairs of Russia that a parcel of trustworthy information based on personal investigation is most heartily welcome; we were therefore exceedingly pleased to receive a brief statement on the subject from Mr. C. le Maistre, C.B.E., General Secretary of the International Electrotechnical Commission, who has just returned from an extended tour in that country at the special invitation of the resuscitated Russian Electrotechnical Committee. Mr. le Maistre cares nothing for politics—he is concerned only with technical matters, though, be it said, his proposed visit received the cordial approval of the Russian Government—and to engineering readers it is superfluous to remark that whatever he has to say with regard to his observations may be relied upon to be accurate and free from prejudice.

In the first place, Mr. le Maistre appeals on behalf of the technical men of all descriptions in Russia for current literature, of which at present they are almost entirely bereft. He desires engineering societies and institutions, manufacturing firms, and others who issue technical literature to communicate with him at 28, Victoria Street, when he will be glad to furnish them with the addresses of persons who will be most grateful for such publications and will put them to the best use—it is important to note that on no account must they be sent to Mr. le Maistre. Whilst, as he says, the present prospect of doing business with Russia may be somewhat unattractive, it is most necessary and desirable that we should keep in close touch with the technical men with whom we shall have to deal when better times return. We strongly commend this proposal to the attention of our readers, not only on the ground of sympathy with our brother engineers in their present difficulties, but also on behalf of the interests of our export trade in the future.

Mr. le Maistre finds that the technical world in Russia is seething with activity and full of quiet enthusiasm; moreover, it is in high favour with the Soviet Government, and is encouraged to put forth every effort to set the wheels of industry in motion. He believes that it will play the leading part in restoring prosperity and progress in Russia—a view which, it may be remembered, has been held also by its rulers. Russian engineers are most keenly interested in and indeed anxious to avail themselves of all the work of the I.E.C., and hope to be able to take part in the next meeting wherever it may be held. The international rating of electrical machinery will naturally be of peculiar importance to Russia in its dealings with those countries from which it purchases electrical machines—as in the near future it will be bound to do. He had the opportunity of addressing and conferring with several committees of scientists and engineers, and met the leaders of scientific thought, including Professor Châtelain, well known to members of the I.E.C., and the trusted President of the Central Electrotechnical Council for Russia as well as of the Russian National Committee of the I.E.C., Professor Mitkowitch, the Russian Faraday, Professor

Voronoff, and others. He also met many other engineers whose reputation extends far beyond the Russian borders, and everywhere he was impressed with the same feeling—that the Russians are "looking forward," and that they are desirous of cultivating the friendship of this country.

Like Mr. le Maistre, we as a journal are not politicians, and we express no opinions with regard to Russian politics; but in the evolution of Russian industry we are deeply interested. In that vast country there is immense scope for development, in which we can help; and that implies employment for our workless population. We do not wish to err on the side of optimism, or to paint a rosy picture, but we are cheered by Mr. le Maistre's report, and we trust that he may be induced when time permits to publish a complete account of his observations. He returned from Russia with Senator Wheeler, of Moritana, U.S.A., one of the few newly elected Senators who have come over to inform themselves at first hand as to the conditions in Europe to-day, including Russia, and it is gratifying to think that our American cousins will also be urged to assist our Russian friends in their colossal task of reconstruction.

We have for many months devoted a proportion of our space to Russian affairs, and while we cannot guarantee that all the information we receive and publish is accurate and trustworthy, we hope that in the main it may be useful to our readers; Mr. le Maistre's remarks certainly tend to reassure us on this point, and incidentally we are pleased to learn that he found the Electrical Review widely read and deeply appreciated in Russia.

International Interlinking.

The benefits of interlinking power systems have nowhere been more fully recognised than in the United States; although in the Eastern States the work of interconnection is only now in progress, there exist in the West examples of, literally, hundreds of power stations coupled together and feeding into one huge system. Hitherto, however, such coupling up has been confined to the limits of one nationality, and where electrical energy has been transmitted over the border the arrangement has not been reciprocal.

The scheme put forward at the Spring Convention of the American I.E.E. on April 25th by a Westinghouse engineer, Mr. Paul T. Brady, therefore, represents an interesting departure from the normal. Mr. Brady declares that power—the means for doing work—is the one thing that enables man to rise above savagery; and an abundant supply of electricity must be given to everyone in the United States and Canada, by putting water-power to work and pouring energy "into a single great international network," by which it will be distributed to "practically every inhabited portion of the continent." This is indeed thinking on a continental scale, and we admire the bold conception of Mr. Brady and his colleagues. But he does not stop there; water-power cannot be relied upon to maintain a uniform supply of electricity, on account of the occurrence of dry seasons—hence, he says, let the water power of Canada be linked up with the steam-power of the United States coalfields, on which huge steam-driven stations will be erected, ample supplies of condensing water being available there. The narrow-minded objections of engineers connected with steam plant, who say they have no need of water power and can gain nothing from becoming part of a larger system, are rebuked on the grounds that there are millions of people who are either paying high prices for electricity or are unable to get it at any price, and that it is their duty in the national interest "to supply the country as a whole with power at the lowest cost." By using water power and coal in co-operation, says Mr. Brady, increased prosperity will be conferred on all the people in North-eastern North America. "Good work is no excuse for not doing better work. The welfare of all people transcends the welfare of a few."

Mr. Brady is in the right, and we hope that he will live to see his dream come true; but in the light of past history we know that many obstacles will have to be overcome before his ideas are consummated.

Trade Problems of Britain.

The greater portion of Sir Eric Geddes's speech at the annual meeting of the Association of Trade Protection Societies of the United Kingdom, held last week in London, was devoted to the effect of the present situation in Europe upon British Industry. Though as the result of the Ruhr occupation there had been a slight temporary boom in certain of our trades—coal, iron and steel—with a slight tendency to a sympathetic rise in certain connected industries, there was a very serious set-back in wool and cotton textiles and other trades. Sir Eric remarked that the situation in the Ruhr must in the end have a damaging effect upon the purchasing power of France, Belgium, and Germany, and upon that of other countries with which they had been in the habit of doing business. The recovery of our export trade was the direction in which we must look for reduction of unemployment. Figures were quoted to show that unemployment is worse in our manufacturing trades for export than it is in industries mainly engaged in home trade. Sir Eric holds that the state of industrial affairs here renders it desirable that we should abandon the present British attitude of onlooker, and he added that the mere fact that there is no settlement of the European problem is costing us enormous sums though we are not taking any active part in the Ruhr operations. He had something to say regarding the effect of European tariff policies and dumping by depreciated currency countries. He urged the importance of requiring the marking of foreign imports into the United Kingdom. He held that it would beneficially affect employment in this country, in so far as it is hit by the import of articles manufactured cheaply in countries with low grade labour or mainly with depreciated currencies, if every purchaser were able to know when a foreign-made article was being offered. Especially at the present time was it in the public interest that there should be compulsory marking from which one could judge, say, a German-made article. "To-day you buy German or French goods without knowing, and you pay doles to our willing workers who cannot get work." The most natural thought to follow from such a remark related to the folly of placing British contracts abroad, and in this connection it is noticeable that a French mechanical engineering concern has been advertising for fitters, electricians, mill-hands, polishers, &c., to go from this country to France to manufacture an article which is largely shipped to this country, or is in competition with us elsewhere. "We therefore have the unsatisfactory situation that British capital, British goodwill, and British skill are being exported to other countries in order to manufacture there." The speech was concluded with a warning that the position here did not warrant complacency on the part of anybody—either industrial or Governmental—its closing sentence being: "England will not fail if those who lead her have the courage of those whom they lead. Tranquillity never won a battle yet."

Mechanical Improvements in Coal Mines.

At the recent meeting of the shareholders of Messrs. D. Davis & Sons, Ltd., Sir David R. Llewellyn, the chairman of the company, said that during the past year their collieries produced 1,489,382 tons of coal, as compared with an average output over the past ten years of 1,336,670 tons. The number of persons employed was 7,200, compared with 6,430 in 1914. The output per shift per collier—that is, the productive man—employed at the coal face was 38.52 cwt. in 1922, compared with 34.5 cwt. in 1914; while the output of all persons employed was 16.2 cwt., as compared with 17.4 cwt. in 1914.

It will be observed that although the output per "collier" increased, the output per man employed decreased. This is the effect of the "Seven Hours Act," which while the pressure of economic and other conditions increased the output of the "collier pieceworker" necessitated the employment of an increased number of "day wage" men, so that the net result of the "Seven Hours Act," instead of benefiting the "pieceworker," actually gives him a greater burden to bear, seeing that the wages paid to these extra men have to come out of the price of the coal actually produced.

Sir David said, however, that one of the most direct causes of the increased production was the improved mechanical equipment of the collieries, and at the same time he discounted the legend propagated by the miners' leaders, and by others who would like to run the coal-mining industry for the benefit of the nation, that there had been no improvement in the mechanical equipment of the mines. Sir David R. Llewellyn, in fact, introduced the first electric coal-cutting machine into the South Wales district twenty years ago, but it is one thing to build a machine and another to work it successfully, and as Sir David said: "On the whole, however, their application has not, I admit, been very successful. In some seams success has been achieved, but in others the coal-cutting machine has been disappointing. This has been due to a great extent to the physical conditions underground, but also in a lesser degree to the antagonism of the workmen." This is the experience of many mine managers, but under the very able management of the B.M.F., assisted by Mr. Sidney Webb, all the difficulties and especially the "antagonism" would disappear!

Another means of helping to increase the production has been the installation of coal conveyors; this has made considerable headway in recent years, and is now engaging the serious attention of all mining engineers. It is applicable mainly to the "Longwall" system of working, and as 90 per cent. of the coal in South Wales is mined on this system, the officials and workmen have during the past forty years become very expert in dealing with roof conditions. It is this expert knowledge and experience which so largely contributes to the successful working of conveyors. Sir David is very enthusiastic about their usefulness, and says:—

"Given the co-operation of the workmen and the officials of the Miners' Federation in the arrangement of the price lists, coal conveying will revolutionise the production of coal during the next few years. It increases the safety of working underground, and tends to lessen the number of accidents at the coal face; it will also reduce dead-work costs, and it will enable thin seams which cannot now be economically worked by hand labour and the old system of stall roads to be worked at a profit. We have introduced several conveyors into the thinner seams, and we are now actively engaged in the installation of compressed-air machinery for the further extension of this practice. I hope I am not labouring this point unduly, but I am giving these facts not merely as a rebuttal of the unfounded criticisms of miners' leaders and others, that the organisation of the industry on its technical side is not being improved, but also because I feel that the increased use of coal conveyors has a very important bearing upon the future of this company."

Messrs. Davis are to be congratulated on their enterprise and the successful development of the mechanical side of mining, and their example will certainly be followed by others, with the result that if the B.M.F. will only leave things alone, the British mining industry will not only reach the output of 1913, but will certainly increase it, to the very great benefit of the miners themselves and the community at large.

Electricity Supply Legislation in Belgium.

It is announced that the Belgian Government will introduce a Bill in the near future to deal with the distribution of electricity. The industry is at present controlled on the basis of a general law passed over a century ago, and although some towns have provided their own gas and electricity works under the powers of this law, most of them have granted monopoly concessions to private undertakings for these purposes or the works are carried on for the account of the towns or communes. These local authorities or these concessionnaires hold a monopoly right of user of the roads within the respective local areas concerned, and can thus prevent any outside supply companies or groups from laying cables through the towns or communes. On the other hand, the State main roads are available to electricity distributors, as also are the provincial roads, for the laying of cables. With a view to ensuring the maximum of economy in production, a tendency has been manifested for some time past to group together the private generating stations of industrial works, but in these cases the use of the roads in towns and communes for the establishment of interconnecting cables is out of the question where existing supply concessions are in force. This problem, together with others relating to the electricity supply question, was referred by the Government to a commission of inquiry in 1920, and that commission has now prepared a report which will serve the basis of the projected legislation.

According to a Belgian newspaper, the commission has prepared a scheme which forms a compromise between the various interests concerned, by providing for the fixing of a limit in the grant of monopoly concessions for motive power. The scheme admits for motive power the principle of concessions up to a maximum power on all the roads of the State, the provinces, and the communes, and without any limit in the case of lighting. Beyond the maximum power of the concession, all the roads will be able to be used by any one for the supply of electrical energy or for the establishment of groups of generating stations by means of interconnecting cables. Such utilisation will be made possible by the issue of a permit, subject to conditions imposed by the public authorities, but the permit will not represent a monopoly. In the case of the communes where concessions exist, the existing system with regard to the roads will not be modified before the expiration of the concessions, although road "wayleaves" can be granted as a result of a declaration of public utility and on the payment of compensation to the holders of the concession. On the other hand, the new system, as proposed, would come into immediate application in the case of communes where concessions are not in existence.

Argentine Railway Electrification.

The article which we commence elsewhere in this issue, describing the electrical equipment of 70 miles (single track) of the Buenos Ayres Western Railway, affords a further indication of the fact that British engineers can hold their own in this exceedingly important branch of electrical engineering; the whole of the plant and rolling stock is of British design and manufacture. Messrs. Merz & McLellan are again responsible for the electrical features of the undertaking, and have adopted their well-known "unit" system in the arrangement of the plant in the generating station.

It is gratifying to find that on this occasion trade follows capital, as it should. This country has expended large sums on development in the Argentine Republic, and it is but reasonable that new construction should be carried out by British hands and brains. Given stable conditions and fair competition, the electrification of the railways of the world should bring an immense amount of work to our factories, and therefore we earnestly hope that some lasting solution may soon be found for the European disturbances which are exerting so detrimental an influence on the progress of the nations towards renewed prosperity.

D

SINGLE-PHASE SHUNT COMMUTATOR MOTORS.

By N. PENSABENE-PEREZ, M.I.E.E.

The single-phase commutator motor having a shunt characteristic has been known for a considerable number of years, yet its application, in spite of its great merits, has been very limited, owing partially to the general lack of understanding of its working either from the designer's or from the user's point of view. The former lack of understanding is responsible for its high cost and mediocre performance, and the latter for a sceptical and conservative attitude and prejudice against the use of commutators.

Thus, such wasteful and poor apparatus as the single-phase induction motor has held the field of industrial application entirely unchallenged until recently, when, on account of its low power factor, a stage has been reached "when we are faced with the capital outlay in the generating stations and cables capable of transmitting something like 50 to 70 per cent. in excess of the real power load they carry." (See remarks by Mr. Ll. B. Atkinson; I.E.E. *Journal*, Vol. 60, p. 317.)

The wattless current which a station has to supply, apart from being a source of great copper loss in the cables, demagnetises the generators, thus reducing their capacity as measured in kVA and affecting their inherent voltage regulation.

This matter, while affecting directly the supply corporations, is bound to affect, in the long run, also the power user, because, whether he is charged or not for the low power factor of his motors, he must eventually pay for the unused capital outlay of the generating stations and network due to their carrying large wattless currents.

The principal culprit responsible for this state of affairs is the small-power induction motor having a power factor at full load varying from 0.5 to 0.75, according to speed and frequency, and absorbing something like two-thirds or three-quarters of its full-load current when running light.

In fig. 1 the average performance of a 4-b.h.p. single-phase induction (or induction repulsion) motor running at its best speed is given, and is self-explanatory.

It will be seen that such a motor on fractional loads takes far more wattless power than true useful power, plus losses; in other words, it is more a choking coil than it is a motor.

A commutator shunt-type motor, on the other hand, can be made to have a leading current when running light and unity power factor at full load; its efficiency is comparable to that of a d.c. motor. Its speed is almost constant at all loads; its starting torque can be made equal to or larger than the full-load torque, while its starting current can be kept in the neighbourhood of its full-load current. Moreover, it can be started without the assistance of auxiliary apparatus apart from a simple double-pole switch. The commutation of this type of motor at synchronism can be made as good as that of any ordinary low-voltage d.c. machine without interpoles.

This motor for comparatively small powers can be also made of the adjustable-speed type up to twice the synchronous speed or more, and all along its speed range it keeps its shunt characteristic—that is, when adjusted for any desired speed, it runs approximately at that speed at all loads.

In fig. 2 is given the performance of a 4-b.h.p., 1,450-r.p.m., 50-cycle motor made by the Electro-Dynamic Construction Co., Ltd., London. From the curve it will be seen that far from absorbing any wattless current, this motor on fractional loads supplies leading current to the system.

If the motor user supplies wattless leading power to the station instead of loading it with wattless lagging power, is it too much to expect that his services should be paid for in the form of lower charges?

The supply companies are well aware of the position of affairs, and the new method of charging in operation or in the way of being so, will bring home to the user the truth that a high power factor is not only the supply companies' concern, and that the few pounds extra paid for a good motor are repaid several times over after a few months in the form of a lower power bill.

The modern shunt a.c. commutator motor, unlike the series type, does not resemble its d.c. prototype, and its name is only due to the fact that its speed does not depend to any extent on its load.

A shunt d.c. motor having a laminated field system is unsuitable for a.c. work because the flux produced by the shunt is in time quadrature with the supply voltage, which therefore can only be balanced by the reactance voltage produced by the wattless armature current. This current, if the supply voltage is constant, must also be constant, and, being in phase with the flux, produces a constant torque at all speeds.

Such a motor, therefore, apart from having a very poor power factor, cannot operate without the help of auxiliary apparatus to adjust its torque to the load torque by shunt regulation or armature voltage control.

A capacity to balance the field reactance, or a special exciter and the addition of a compensating winding,

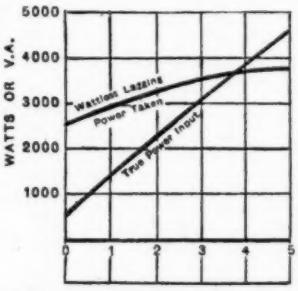


Fig. 1.—Performance of s.p. Induction Motor.

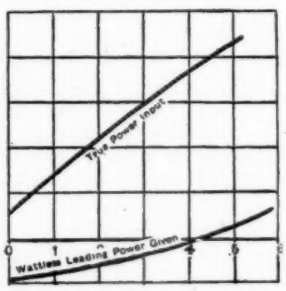


Fig. 2.—Performance of s.p. Shunt Commutator Motor.

have been suggested to make this motor of practical use, and the modern shunt motor has been evolved out of such earlier attempts as are shown in fig. 3, where we have:—

(A) Plain d.c. connections. (B) Capacity to balance the field reactance and compensating winding, hence flux Nx in phase with supply voltage and armature m.m.f. neutralised, no flux in the vertical axis. (C) Current in the armature induced by transformer action, hence flux Ny in the vertical axis at 90 deg. to the supply voltage. (D) The e.m.f. due to Ny by rotation produces a flux Nx at 90 deg. and approximately in phase with the supply voltage.

It will be seen that in (C) a very important feature is introduced, *viz.*, the creation of two fluxes at 90 deg. in line and space and the elimination at synchronism of the sparking voltage induced in the short-circuited coils by transformer action.

In (D), while this feature is maintained and the condenser is eliminated, a weak feature is introduced, *viz.*, the dependence of the motor flux Nx on the speed and the consequential inability of the motor to produce a torque at starting. The current in the Y axis of the armature is produced by the vectorial difference between the e.m.f. due to transformer action and the e.m.f. induced by rotation in the field Nx, hence the higher the speed the smaller the current and also the torque, which becomes nil at synchronism. This motor has therefore a shunt characteristic.

The uncompensated motor of this type has a very low

power factor and a light-running current almost double its magnetising current.

In order to improve the power factor, a voltage in phase with the supply voltage is applied in its axis, and the different ways of doing this are the subject-matter of a great number of patents.

It is not proposed in these short notes to give the theory of this motor, which is far from being simple.

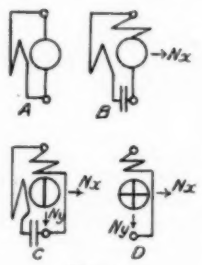


Fig. 3.

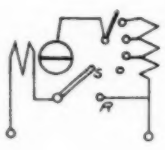


Fig. 4.

The writer has developed a working vector diagram of this motor which agrees in a remarkable degree with the result of tests, and hopes to publish it in the near future. For the present it may be of some interest to give the value of the running-light current arrived at:—

$$i_o = i_m \left[1 + b \sqrt{(1 + \sigma)} - a\right] / \left[1 + b\,\sigma / \sqrt{(1 + \sigma)}\right]$$

where io is the light-running current, im the magnetising current, σ the leakage factor, a the ratio between the voltage injected in the X axis and the armature resistance drop due to the rotor magnetising current, b the ratio of total iron and copper loss in the motor axis to the copper loss. It is clear that the light-running current becomes leading current when its value, as given by the formula, is negative.

Some interesting conclusions may be derived from the above formula: (1) The light-running current of a shunt a.c. commutator motor is a function of the copper loss as well as the iron loss in the motor axis. (2) Other factors being the same, the no-load current increases (if lagging) or decreases (if leading) with increased iron loss.

The sparking of a shunt a.c. commutator motor is due to the reactance voltage as the result of the reversal of the current in the coils undergoing commutation and of the voltage induced in them by rotation and transformer action by the fluxes Nx and Ny.

The former voltage is nothing else than the usual reactance voltage found in d.c. machines; the latter voltage is proportional to $Ny\ f - Nx\ fo$, where Ny and Nx are the transformer and motor fluxes, and f and fo the supply and rotation frequencies.

Near synchronism, as the two fluxes are then nearly equal and in quadrature, this sparking voltage is negligible, and it only appears when speed regulation is required.

As mentioned before, this motor has no torque at standstill, and must be started as a series or repulsion machine.

In fig. 4 a method generally used, when possible, by the Electro-Dynamic Construction Co., Ltd., is given, embodying also speed regulation by means of reactance control.

If no speed regulation is required, the starting of the motor is simply effected by opening switch s at starting and by closing it near synchronism.

As regards price, such a motor compares favourably with the slip-ring type, plus plain starter, and also with the usual induction repulsion type.

SOME ASPECTS OF THE BROADCASTING POSITION.

By W. H. STOKER, K.C.

Some interesting questions arise with regard to the position as between the Government, the British Broadcasting Co., Ltd., and the public. The Wireless Telegraphy Act, 1904 (4 Edward VII C. 24), passed in consequence of the developments in electrical science, was introduced at the close of the Parliamentary session of 1904, and the debate on its provisions was curtailed by reason of this. Lord Stanley, the then Postmaster-General, in moving the second reading of the Bill on August 10th, 1904, stated that there were two principles that he had endeavoured to embody in the Bill; first, that the safety of the nation in time of danger should be secured by the Government being allowed to exercise control over wireless telegraphy; and secondly, that they should not allow a big monopoly to grow up, which at some time the State might have to purchase, as in the case of the telephone monopoly. He added that the class with whom he had the greatest sympathy were those who wished to go in for experiments in that science, and he had been able to frame a clause which would give absolute freedom in that direction, merely requiring registration on the part of those who wished to engage in experiments. And for what it was worth he gave an undertaking that no request for a licence for experiments should be refused unless the refusal had been approved by him personally. Although this undertaking is not binding on Lord Stanley's successors in office, and the volume of applications must be embarrassing, it is yet to be hoped that the present Postmaster-General in sending, as announced by him recently in the House of Commons, the 33,000 applications stated by him to be pending, to experts on his staff to make a thorough investigation and to advise him which, in their opinion, are honestly experimental, will still exercise some element of personal judgment as to refusal or non-refusal, and not merely shift the decision on to his staff. The proviso to Section 1, Sub-section (7), which appears in the Act as passed, is also worthy of notice. This proviso is that nothing in the Act is to prevent any person from making or using electrical apparatus for actuating machinery, or for any purpose other than the transmission of messages. It was stated by the mover of the amendment adding this proviso, that unless such words were added the Bill might interfere with enterprise and scientific exploration, and it was accepted without discussion. But the existence of this proviso not only throws some doubt on the absolute necessity for experimental licences in some cases of experimenters, but also raises the question whether the use of apparatus merely for receiving messages or for merely listening to other people's messages, and *a fortiori* to musical or dramatic performances, requires any licence. A question arises also on the general provisions of the Act whether the "transmission" of messages or communications includes the transmission of musical performances merely instrumental, or partly instrumental and partly vocal, or vocal alone, or of dramatic performances or recitals.

The Telegraph Act of 1869 was designed to secure to the Postmaster-General the monopoly of sending or transmitting messages or other communications by telegraphy, that is to say, messages sent along wires by means of electricity, and the receipt and delivery of messages as incidental to their transmission. The Courts afterwards, on the development and use of the telephone, held in the case of the Attorney-General *v.* Edison Telephone Co. that this extended to and included spoken conversations through the telephone, and that such conversations were messages. There was no appeal in the case,

and the decision must be accepted as being the law. Following on it, the telephone companies had to get licences to carry on their business from the Postmaster-General, who later terminated these and took over and worked the existing telephone systems as a branch of his Department. The Wireless Telegraphy Act, 1904, extended the principle of Government control to electrical communications and messages without the use of wires, including, necessarily (on the authority of the case before referred to), telephonic spoken messages or conversations. Under the Wireless Telegraphy Act, 1904, no person may establish any wireless telegraph station or install or work any apparatus for wireless telegraphy (as defined) except under licence from the Postmaster-General. Wireless telegraphy is defined as meaning any system of communication by telegraph as defined in the Telegraph Acts, 1863 to 1904, without the aid of any wire connecting the points from and at which the messages or other communications are sent and received; but there is the proviso already noticed as to nothing preventing any person from making or using electrical apparatus for actuating machinery, or for any purpose other than the transmission of messages. Telegraph is defined in the two Acts of 1863 and 1869 as a wire or wires used for the purpose of telegraphic communication . . . . and any apparatus connected therewith for the purpose of telegraphic communication, and also as meaning and including any apparatus for transmitting messages or other communications by means of electric signals; and "telegram" means any message or other communication transmitted or intended for transmission by a telegraph. The Act of 1869 invests the Postmaster-General with the sole privilege, with certain exceptions applying mainly to private telegraphic systems in which no charge is made, of transmitting telegrams within the United Kingdom, and of performing all the incidental services of receiving, collecting or delivering telegrams.

To summarise, the Wireless Telegraphy Act, 1904, would seem to cover only apparatus for the transmission by wireless telegraphy of messages or communications in the nature of messages, and the receipt of these as incidental to their transmission. Questions therefore arise (1) whether a licence is necessary for apparatus for the receipt of messages or communications where such receipt is not incidental to their transmission; (2) whether a licence is necessary for the transmission, broadcast or otherwise, of music or other things not being messages or communications in the nature of messages, and in any case (3) whether a licence is necessary for apparatus used solely for picking up and listening to broadcast musical and dramatic performances. As regards (2) it is interesting to note that in the licence granted to the British Broadcasting Co., Ltd., on January 18th, 1923, which is now a public print, the term "telephone" is defined as including telephonic transmitting or receiving instruments for transmitting or receiving (amongst other things) music by electricity, and there is also a definition of "broadcast matter" as meaning concerts, lectures, theatrical entertainments, and any other matter from time to time approved by the Postmaster-General. But, in the absence of any enactment or order having legislative force importing or carrying such definitions, they are merely part and parcel of the terms of this licence as between the Postmaster-General and the grantees, and bind only these. The part of the licence which most concerns the public is the agreement on the part of the Postmaster-General tacked on to and incorporated in it (Clause 25), under which the Postmaster-General is to make it a condition of all licences granted by him to persons authorising them to establish wireless telegraph stations for the purpose of *receiving messages only* (called "broadcast licences) during the continuance of the licence to the British Broadcasting Co., that any receiving sets or parts therein specified shall bear the mark "B.B.C." within a circle bearing the words "Type approved by the Postmaster-General" in the margin thereof; that not less than 10s. per annum payable in advance is to be paid to the Postmaster-General for each broadcast licence; and that the Postmaster-General is to pay to the British Broadcasting Co., Ltd., a sum equal to 50 per cent. of the sum received by him in respect of fees for broadcast licences. If no licence is really legally necessary in respect of apparatus used for listening to or receiving the entertainments provided broadcast by the British Broadcasting Co., Ltd., these provisions are somewhat illusory, to say the least, and the company may have a legitimate grievance, not against members of the public with unlicensed listening-in apparatus, but against the Postmaster-General. But, if this part of the licence is enforceable against the public, the question will naturally arise as to the action of the Postmaster-General in tacking an agreement of this description on to a licence, as to his right to do so, and whether it is not opposed to the statement made by Lord Stanley before referred to in introducing the Wireless Telegraphy Bill, that one of the two principles he had endeavoured to embody in it was that the Government should not allow a big monopoly to grow up. The terms of the agreement between manufacturers and the British Broadcasting Co., Ltd., scheduled to the licence of January 18th, 1923, under which the manufacturer is to acquire at least one share in the company at par value, and under which the company is to receive from such manufacturer substantial sums in respect of apparatus sold by the manufacturer, form a further feature of the whole scheme which no doubt the Committee which has been appointed to go into the whole matter and the many difficult features involved will consider impartially.

WARMING BY LOW-TEMPERATURE ELECTRIC PANELS.

We recently inspected a number of the electrically-warmed panels, &c., which have been introduced by Messrs. Grierson, Ltd., installed at their offices, and were much interested in the results obtained. The word "warming" is used in the title of this note in contradistinction to "heating," in order to emphasise the fact that a comparatively low temperature is an essential feature of the system; the resistance conductors operate at temperatures between 140 and 170 deg. F., and the surface of the panels is not as hot as the water in an ordinary hot bath. The effect produced, however, is as surprising as the economy of energy that is achieved.

The physical fact that all bodies above absolute zero of temperature are constantly radiating heat to their surroundings (and receiving radiant heat from the latter) is not usually appreciated, even by technical men—certainly not by the layman. For this reason it is impossible to ascertain the true temperature of the air in a room by suspending a thermometer in it, unless by chance the temperature of the walls happens to be identical with that of the air, and when Mr. A. H. Barker, of University College, London, desired to determine this quantity accurately, he found no little difficulty in attaining his object. All objects radiate heat all the time; those which are at a lower temperature than others gain on balance. A dull black surface at a temperature of 100 deg. may radiate many times as much heat as a highly-polished surface at 200 deg.; though the heat rays do not affect our optic nerves, they are identical with light rays but of longer wavelength, and are propagated in straight lines like light.

Hence if a large surface is raised a few degrees above the temperature of surrounding objects, it will pour forth a stream of heat large in cross section but of low "head," which passes through the air without heating

it appreciably, but is in great measure absorbed by any solid object in its path. The case is analogous to that of diffused illumination from a white wall or ceiling, whilst heating by means of red-hot radiators of comparatively small dimensions is comparable to that of direct lighting by flood-light projectors. Both systems have their appropriate uses.

Unlike the lighting case, however, it appears that warming by diffusion is more economical than direct heating. The company finds that with a consumption of less than one kilowatt a room measuring 16 ft. by 14 ft. can be made comfortable for the occupants in cold weather, with the thermometer standing at 40 or 45 deg. F. This is in accordance with the results obtained by Mr. Barker, which we described in our issues of December 17th, 1915, and February 4th, 1916; in collaboration with Prof. Leonard Hill, he found that cool air was refreshing, especially if it were "streaky"—not of uniform temperature—and that a person could be perfectly comfortable whilst sitting still in air at 40 deg. F., if radiant heat were supplied to him at the rate of less than two watts per square foot. The fact is, of course, that we use an enormous excess of heat energy in our homes, far more than would be necessary to our comfort did we know how to use it most efficiently.

The method which Messrs. Grierson have adopted to solve the problem is to employ a large surface maintained at a comparatively low temperature; the result is a gentle warming effect which is distributed throughout a room, so that there is no need for the user to seat himself close to or directly in line with the source of radiation. The heating element never attains a temperature approaching boiling point; it can therefore be safely embedded in plaster, put behind tapestries, or under floor coverings, or incorporated in movable manifold screens. Maintenance costs, of course, are negligible, and—what is still more important—the amount of energy consumed is remarkably small. The effect in no way depends upon heating the air, so that ventilation is unhindered, and the windows can be left wide open on a still day with the outside air at 45 deg. F. without the slightest discomfort. Such a system lends itself to a variety of new applications; for example, electrically-warmed panels can be fixed in draughty parts of theatres, and a noteworthy application is to dressmakers' mirrors and pier glasses—for which purpose more than 50 have been ordered in one batch for use in fitting rooms by one of the big London drapery firms. The system represents a notable departure from common practice and conventional ideas, so that much educational work will have to be done before the public conservatism is overcome, but we believe it will have a great future.

PARLIAMENTARY NOTES.

[By Our Special Parliamentary Reporter.]

Potteries and North Staffordshire Tramways and Light Railways Bill.—This Bill was considered by the Unopposed Committee of the House of Commons, presided over by Mr. J. FitzAlan Hope, on May 9th. Mr. Brown explained that the Bill was promoted by the Potteries Electric Traction Co., Ltd., and the North Staffordshire Tramways Co., Ltd., which were separate companies, but between which the working arrangements were very close, so that for all practical purposes the two undertakings formed one system of traction. The undertakings were situated in the districts of several local authorities, and by reason of the fact that the tramways and light railways of the companies had been authorised at different dates, the dates on which the local authorities could purchase compulsorily the portions of the undertakings which were in their districts were very far from synchronising; therefore, if the local authorities decided to purchase, there would be a great deal of inconvenience to both the tramway undertakings and themselves, and the main object of the Bill was to synchronise the dates of purchase in order to give the local authorities, if they wished, the opportunity of acquiring the whole undertaking at the same time. In consideration of that the date for purchase was fixed at 1925, and the local authorities had agreed that unless they purchased at that date the companies should be left alone until 1950, after which the intervals should be 30 years. That would place the companies in a more secure position than under existing conditions, and would assist them to raise necessary finances.

The other principal provision of the Bill was one which enabled the Minister of Transport, on the representation of the companies, if he were satisfied on certain points, *e.g.*, that a particular tramway or portion of a tramway, could not be worked remuneratively, or that the requirements of public traffic on the routes served were or could be served by other means, to make an Order authorising the companies to abandon any particular line or portion of it. The form of the clause has been questioned, however, by the Minister of Transport. After some discussion the Committee announced that the preamble of the Bill was proved, subject to the final settlement of the form of the clause.

Applications for Patents.—On May 8th, Lord Wolmer informed Mr. Ede that the number of applications for patents awaiting examination in the Patent Office was approximately 6,000. The congestion of work had been principally due to the arrears caused by war conditions, and the revival of foreign applications suspended during the war. Every possible step had been taken, by a temporary increase of the staff and otherwise, to remedy the existing conditions, and the arrears had been reduced by over 3,000 cases during the last two years at an increasing rate, and he had every hope that the return to normal conditions would not long be delayed.

Private Bills.—The Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board Bill has been read a third time in the House of Lords.

CORRESPONDENCE.

Letters received by us after 5 p.m. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Trading Organisation.

Business is business all the world over; whether it is selling butter or battleships, the same broad principles apply. A profit must generally be made on the transaction to satisfy the seller, and the buyer must derive satisfaction from his purchase. Each industry has its own peculiarities, and those which are applicable to one are not necessarily so to another; this holds good even with kindred industries.

The report of the Special Policy Committee of the E.C.A., published in your issue of May 4th, and commented upon in your leading article of the same date, no doubt is a step in the right direction. I understand it to be a policy to "Organise" the trading section of that portion of the electrical industry, and by that means supply the user with his requirements at a more economical price, and thereby stimulate trade. That is progress in the right direction, but should the policy develop into one of increasing prices to benefit all traders concerned and not the user, then I do not believe it will be a sound one. Healthy competition is the making of industry. Many selfish combines have been formed from time to time with the idea of maintaining prices above an economic level, in most cases without success; should they apparently be successful, then the excess profit, above the economic level, is generally expended in indiscreet advertising or unnecessary expenditure in other directions; the last state of affairs is no better than the first. Competition is like electrical resistance; at a casual glance it appears to be a curse, but it is a blessing that nature has provided us with it. If it were not for competition, possibly to-day we should still live in the stone age. Organisation has improved, and a large number of inventions have come into existence, through one man trying to produce more than his competitors, and that desire must not be retarded.

With reference to my earlier remarks, I repeat that each branch of industry has its own peculiarities, and what applies to the accessories side does not necessarily apply to other branches. Take that of the electric motor industry: The mechanical parts are manufactured in quantities and stocked by the maker; it reduces the cost of production little or nothing if one machine or one hundred are wound at a time. I dare to say there is not one wholesaler in this country to-day that could give a stock order for twenty 10-h.p. motors at a time. This is not the position with the accessories side of the electrical industry. The manufacturer who makes tumbler switches, for instance, could not efficiently distribute them even in dozens, let alone smaller quantities. This involves a different method of distribution. The accessories may go through two stages before they arrive at the user, and the motor one stage. In my opinion the manufacturer should always be at liberty to sell direct to the user, but he must charge the same price as the middle-man would have to. Trade organisation to promote that object and combinations to improve the quality of the product are good, but unfortunately the ultimate object is generally to

endeavour to maintain prices above an economic level. I am a believer in the open door, remembering the quotation :—

" What is the use of having a thing unless you are allowed to show it,
But to know a thing is nothing unless others know you know it."

If one has a good idea he can generally protect it in a proper manner by patents. Manufacturers do not interchange ideas sufficiently; some are afraid of giving away the methods they employ to their competitors. That which one man can accomplish, can also be achieved by certain others, and it is narrow-mindedness for one to think that he gains by keeping his little idea to himself. Competitors are the soundest and most sensible critics, because they know the job. If the whole British electrical industry were to reduce costs by the correct kind of combination, it would be in a better position to compete in foreign markets—and foreign trade is the all-important factor.

In your leader you wisely refer to the great possibilities for the future of the electrical industry; the bulk of immediate future development is likely to be increased production of existing standard articles, therefore the methods of production and organisation of the future are likely to be determining factors in the cost of production, and it is through manufacturers interchanging ideas that these costs can be rapidly and substantially reduced.

Walter F. Higgs.

Birmingham, *May 9th*, 1923.

As a member of the electrical contracting business, I welcome your desire for better organisation and broader co-operation of the retailing, manufacturing, and contracting sections of this huge industry. It is a very wide subject, but some difficulties will be permanently solved, if the recommendation of the special committee be used as a basis of discussion.

The exposure of all useless and adventuring traders in all sections of the industry is essential, if we mean to be successful. There is quite a lot of material and apparatus made and installed, the only merit of which is its low first cost. The maintenance costs and efficiency are only thought of when it is too late. I have met large numbers of electrical users in the factory, and home, who are paying heavily for having entrusted their electrical work to incompetent electrical firms. In many cases the whole equipment has been scrapped, although it cost hundreds of pounds to install.

The manufacturer and the contractor must offer the user equipment which is efficient and economical to maintain.

Quality and efficiency have been the means of building hundreds of businesses. There is no economy in reducing quality. Those of us who spend our time in working out electrical schemes which are really commercial and satisfying are reaping the benefit.

The difficulty is for the genuine little man to maintain this high standard (against the cheap and nasty do-it-anyhow man) for a long enough period to find that it really pays; unless the little man's vision is big he will fall a victim and circumstances may compel him to do work at prices for which he cannot maintain any standard of quality.

With organisation on the lines of the proposals discussed by the N.E.C.T.A. Committee, quality is bound to be improved, and inefficiency, which retards the progress of our industry, to a great extent eliminated.

There should be no room in a scientific calling for either parasites or dabblers, and the only way to safeguard our interests and the interests of those whom we serve is to organise for better and bigger business.

B. Gill.

Leicester, *May 9th*, 1923.

Power Factor.

In your issue of 11th inst. no fewer than three gentlemen kindly comment on my letter published in your " Correspondence " columns of April 27th last. All thanks to the three gentlemen concerned. Mr. E. J. Timberlake virtually confirms a conversation I recently had with him on this subject. Needless to say I agree. Messrs. Industrial Electroplant, Ltd., cast so adroitly that I at once rise and shall take steps to obtain further information, and, I trust, obtain facts. Generally speaking, I believe all three correspondents believe that the power factor improvement effort must emanate from the supply authority. 'F.G.H.'s" letter from Peckham I find most illuminating and interesting, but I do not agree in entirety.

(1) I most certainly agree, but it implies an appreciable amount of instrument transportation and consequent damage to instruments, resulting in inaccuracy and heavy cost. (" Hear, hear! " from the instrument manufacturers.)

(2) The spirit is willing, &c., but those of us who have 20 or 30 years of supply authorities' troubles behind us know that when the station was conceived and became an accomplished fact most of us were only beginning to learn our jobs, and in the absence of a N.J.B. a bare operative staff was all that was necessary or considered desirable from the pecuniary stand-point, *i.e.*, there was no individual with the time, experience, or duty to look after the consumer. And in these days we were all practically d.c. and power factor did not matter. We all know the type of man, a faddist, &c., who specifies a squirrel-cage motor, which shall exert, say 100 per cent. torque at starting, and shall only draw 10 per cent. of full-load current from the line in the first position of the starter. As " F. G. H." says, " a firm of specialists in power application sounds very nice. Wish I were one of that fraternity."

Apart from expenditure on tools, tackle, and plant, every supply authority has to expend a very large sum before it can supply energy, under very stringent obligations to its consumers, yet an a.c. system is so poorly catered for by legislation that the authority cannot refuse to connect a power installation simply because it knows that in connecting it, it is securing a consumer whose motor efficiency cannot possibly exceed 60 per cent. at an average power factor of, say, 0.5. No, sooner or later the supply authority must have discriminating powers and an efficient consumers' power installation engineer with some real power to combat faulty power factor.

With all due deference to " F. G. H." I again submit that (4) poor power factor must sooner or later be tackled by the supply authorities, backed by new legislation and powers, applied through a consumers' power installation engineer plus a kVA demand tariff, and suitable meters produced by meter manufacturers.

In conclusion, will some meter manufacturer please show up my ignorance?

Walter E. Rogers, A.M.I.E.E.

London, *May 13th*, 1923.

Nitrogen from Air.

At the conclusion of my last Cantor lecture on " Nitrates from Air " Dr. Harker made some remarks about certain explosions in plants of the Nitrum Co. I referred the matter to the company and enclose its reply, which I should be glad if you would publish.

As you will see, there were two explosions, and they had nothing to do with the working of the arc process, for they were due to a leakage in the apparatus for freezing out the NO_2 in conjunction with toluol or benzine. Such accidents might happen to any process giving nitrogen dioxide.

As a matter of fact, the method which the Nitrum Co. had written me about, and which I had in mind at my lecture, is an *aqueous* absorption plant, and it is absolutely safe. Dr. Harker's criticism is of the same order as those of gas fanatics, who used to condemn all electric lighting because the fusing of an electric light wire once started a fire; or again, the argument of compressed-air advocates against the use of electric coal cutters because a man once got his leg in a cutter wheel.

It is the special forte of electricity to go sailing serenely along in every industry in which it once gets a foothold, and it confounds its critics at every turn, but it is tragic, as well as somewhat amusing, to see how people will keep clutching at straws in their efforts to stem the electrical tide.

Those who feel they must criticise should " go for " the heads of the powerful trust organisations, who do not want *any process* for making *nitrates from air* to succeed. In the future, when the true inner history of the war comes to be analysed by some one who has the *scientific engineering* outlook, an outstanding fact will be the way in which a group of financial men held this country in the grip of the Chile nitrate octopus. I believe it ranks as the greatest scandal of the war.

E. Kilburn Scott.

London, *May 14th*, 1923.

[Copy of letter.]

E. Kilburn Scott, Esq.,
38, Claremont Square,
London, N.1.

Dear Sir,

In answer to your letter of April 26th we have to state that the explosions at Zschornewitz and Bodio had really nothing to do with the working of the arc process. In the description we sent you on March 12th the nitrogen oxides of the furnace are absorbed in a specially-designed aqueous absorption plant, and there is therefore no danger of any explosion whatever.

The explosions which took place in the plants of Zschornewitz and Bodio happened in a part of the system which has been abandoned. The furnace gases were cooled to a very low temperature of about 70 deg. C. below freezing point, thus freezing out the NO_2 (nitrogen dioxide) contained in the gas current. To transmit the cold at low temperature we used toluol or benzine. Through a leakage in the cooling apparatus the organic cooling liquid mixed with the NO_2 and took fire. As this part of the scheme has been definitely abandoned there is now no danger.

Our Rhina plant is using our patented aqueous absorption, the yield measured at the furnace being about 75/80 grams of nitric acid (100 per cent.) per kWh, the air to the furnace consisting of about 50 per cent. oxygen and 50 per cent. nitrogen.

(Signed) SOCIETE ANONYME NITRUM.

Zurich, *May 9th*, 1923.

The Brilliant Future of Electricity.

May I trespass on your space to urge regarding the future of the electrical industry that optimism is good for the employed and the employer. In no business or industry I think does this apply more fully than in the electrical field.

I have for years past felt that the future for electrical applications in this and other countries is boundless, and that those who prepare themselves for the coming boom will reap to the full the benefit of their foresight and patience.

Whether you have seen or used the enclosed address by Mr. Bump, President of the National Electric Light Association of America, delivered last May, I do not know, but if not, perhaps you may consider it worth reprinting. The point to my mind is that the address refers to the American field, and considering the extent of electrical progress there, I think his deductions apply even more fully to Great Britain.

If it is true that 90 per cent. of the possibilities in America have not yet been realised in spite of the fact that there is no question that America is far in advance of other countries in electrical development, then the future for Great Britain must be bright indeed.

The enormous potential developments in electrical transmission for traction purposes must alone be a tremendous and ultimately successful project, and we should see to it that the industry in this country benefits to the full thereby.

G. W. Mascord.

London, *May 14th*, 1923.

[The following extracts are taken from Mr. Bump's address:—

"Less than half of the homes in America are wired, and certainly less than half of these are adequately wired. No more than half of the industrial wheels are electrically turned. Railroad electrification has scarcely been begun. The fields for electric heating and electric pumping for irrigation are only beginning to be recognised. Combining these factors, it is a perfectly safe statement to say that we have not as yet realised 10 per cent. of the total actual possibilities, in spite of the fact that there is no question that our country is far in advance of other countries in electrical development. Taking the world as a whole, it is doubtful whether more than 2 per cent. of the actual possibilities have been covered.

"The present financial outlook is highly satisfactory. The turn in business conditions has given renewed hope in all industries, but no other industry can face the future with the certain knowledge that there is no possibility of overbuilding for many years to come. . . . Plans under way, which are rapidly becoming realities, will speedily load up our manufacturing capacity of all classes and will tax the industry to find and develop sufficient man-power for construction and installation purposes. Under such conditions an enthusiastic united industry is bound to move forward to success greater than ever before dreamed of and is bound to make for prosperity in every branch of the industry. The opportunity before every individual in the industry is unlimited. A realisation of this opportunity must be placed before every employé, and with this realisation will come a period of development such as we have never known. The future can be just as big as we in the industry make it."

The last sentence, Mr. Mascord points out, may very well apply to British electrical industry also, and we fully agree with him. We are very optimistic with regard to the future of electricity.—Eds. Elec. Rev.]

"Traveller" has omitted to enclose his name and address.

REVIEWS.

Costing and Price Fixing. By J. M. Scott-Maxwell, B.Sc., M.I.E.E. Pp. xii+211; figs. 21. London: Sir Isaac Pitman & Sons, Ltd. Price 5s. net.

This book gives a complete job-costing system suitable for the factory manufacturing a large variety of apparatus, and is particularly applicable to the electrical engineering industry, although, with modifications, it can be used in connection with any type of product which cannot be completed or even started until the order has been actually booked and full technical data received from the customer.

It is written from a practical standpoint, and deals not so much with accounts as with actual shops' practices. The views of the author, as a practical man and the head of a large industrial undertaking, should be of peculiar interest and value to those actively engaged in factory organisation and management, who are desirous of applying up-to-date yet practical methods of job costing.

There is nothing remarkable in the methods advocated, but they are fully in accord with the views of men who write from personal experience rather than from a theoretical standpoint. The outstanding feature is a frank recognition of the inefficiency and ineptitude of modern management in many so-called progressive concerns, and this recognition is of more than usual interest when the high industrial position occupied by the author is taken into consideration.

The introduction of the "engineer-accountant" is not, however, likely to effect an improvement, for this would prove an anomalous position, and one calculated to create friction rather than to promote efficiency. A scientific knowledge of factory management, and all that it implies, would ensure on the one hand a thorough appreciation and understanding of costing ideals, and on the other a mastery of manufacturing conditions which would render those ideals practicable.

The wage systems affecting labour costs are dealt with, including (*a*) time work, (*b*) piecework, (*c*) premium bonus, and (*d*) profit sharing, and after briefly commenting upon the advantages and disadvantages of each (from the standpoint of modern conditions), the author expresses the opinion that the premium bonus (individual) system is the one best calculated to yield results at once satisfying to the operator and the management. Collective bonus, such as the Priestman system, is regarded as suitable only to certain industries where the output can be definitely measured in quantity or weight, and therefore not applicable to the engineering industry as a whole, whilst profit-sharing schemes work only when there are steady and assured profits, and are a continued success only when applied to a monopolist undertaking.

The allocation of "on cost" receives detailed attention, and as this is a matter upon which cost accountants fail to agree, the observations of the author should be of interest. The "on cost" is apportioned to production and sales, but in regard to the former allotment it is noted that "the on cost in connection with the specification, buying, receiving, storing, issuing and costing, also carriage inwards, and the on cost of the material department in the office can be legitimately charged against material . . ." the contention being based upon the fact that all such on cost has to be incurred before any labour whatever is expended. Whilst many cost accountants insist upon charging all production on cost against labour, others advocate the apportionment of a small percentage against material, but whether they would go as far in this direction as suggested by the author is open to question.

More is covered by this book than the title implies, for although job costing is the basis of the work, the whole field of factory organisation and routine is surveyed, and the straightforward and sincere observations of an employer of labour should be of interest to industrialists of all grades. The work is sound rather than brilliant; the style is easy and free from technicalities, and it is published at a price that should attract even those whose means are limited.

W. J. Hiscox.

Connecting Induction Motors. By A. M. Dudley. Pp. xii+252; 289 figs. London: The McGaw-Hill Book Co. Price 15s.

This book carries the hall-mark of an introduction by Mr. B. G. Lamme, and a careful reading of the book from cover to cover confirms that it is high-grade in every respect. All that rests with the reviewer is to describe the nature and scope of the book to show the class of reader for which it is intended.

In the preface the author states that the material which finally developed into the book appeared first in the *Electric Journal* in February, 1916, and was later elaborated into a series of articles which ran for about three years in *Power*. The author is a departmental manager in the Westinghouse works at Pittsburg, and is clearly a master of both the theoretical and practical sides of his subject. If there is one criticism to offer of the book it is that the title is not sufficiently descriptive. In the first and second chapters the author gives the theory of dynamo-electric machinery in a clear and concise manner which must help to a proper understanding of the basic principles. The following eight chapters are devoted to a description of various windings from the double point of view of theory and practice. The remaining chapters deal with finding faults and with rewinding machines for a change of output. The book is freely illustrated, and contains many tables of value for reference. The work is one which should be read by every advanced student, and should have a permanent place in every designs office and works library.

Gears and Gearing. By Capt. S. Bramley-Moore, M.C. Pp. 152; figs. 146. London: Percy Lund, Humphries and Co., Ltd. Price 12s. 6d. net.

Recent developments which have been made in the theory and practice of gear cutting have led to the use of mechanical gearing on a much wider scale than was possible a few years ago, and both as regards the powers transmitted and the speeds employed, gearing is now available for almost every purpose where machinery must be run at a speed different from that of the prime mover. This is of the utmost value to the electrical engineer since the electric motor is essentially a high speed machine, and it very frequently happens that some form of speed reduction device is necessary between the motor and the machine it drives, if the latter is to run under its most economical condition. To a lesser extent—at least as far as numbers are concerned—the use of gearing enables a direct current generator to be driven at its most economical speed while still employing an efficient high-speed turbine as the prime mover.

The fundamental condition for efficient transmission of power by means of toothed wheels is accuracy in the production

of the teeth. In the old days of milling cutters the initial accuracy of the tooth form was soon lost as the cutter became worn, and the result was inefficient gearing which was evident by the noise generated when the gearing was in operation. Recent developments have all been in the direction of greater accuracy in cutting the teeth, and it is significant that no change of tooth form has been proposed, the old involute tooth still being regarded as the best for all forms of modern gearing. It is only in the method of cutting the gears that experts differ. In the book under review, the author has dealt impartially with the various systems of gear cutting, including the well-known hobbing process introduced by Sir Charles Parsons, the shaping process, or Sykes process as it is sometimes termed, and the slotting or Sunderland process. Notes are also given on the subject of grinding gear teeth, the Maag process, which has been so favourably commented on in connection with gearing for electric traction work, being illustrated and described. Notes are given on the production of all forms of toothed gearing comprising ordinary toothed wheels, helical, double helical, bevel spiral and worm gears, and in connection with spiral gears, it may be mentioned that a special chart has been prepared for the determination of the dimensions of these for standard normal pitches. It is claimed by the author that this is the first time a simple yet accurate method of calculating spiral gears has been published.

In the earlier chapters, the author deals with the general subject of gear teeth, and as a means of expressing the dimensions of teeth and the relationship between the dimensions of tooth and wheel, he urges the acceptance of the "British Module Pitch" as the basis of measurement. This is the ratio between the diameter of the pitch circle expressed in inches (as against the metric module where metric measurements are employed) and the number of teeth on the wheel, and is thus the reciprocal of the diametral pitch. Both the module pitch and the diametral pitch are to be preferred to the circular pitch in which the indefinite quantity π necessarily appears, but the British module is to be preferred to the diametral pitch because the addendum of the tooth is exactly equal to the module and thus the various dimensions of the wheels and the distance between the centres of two wheels in gear are all in definite numbers, thereby enabling greater accuracy to be employed in cutting the gears. The tables of dimensions of gears expressed in terms of the three forms of pitch measurement show clearly the advantages of the British module.

The book is well produced, the diagrams being clearly drawn, while the illustrations of the various types of gear-cutting machinery are reproduced on art paper. We confess to not liking the "Gear Rhymes" (for automatically memorising gear formulæ as the author naively suggests); they would suit the rule-of-thumb engineer rather than the scientifically trained craftsman of to-day; but with that reservation we can heartily recommend the book to all who are interested in the important subject of power transmission by gearing.

BUSINESS NOTES.

Bankruptcy Proceedings.—Pearson Rukin, Manchester Road Station, Bradford, electrical engineer.—The first meeting of creditors was held on May 8th at the Official Receiver's Office, 12, Duke Street, Bradford. According to the statement of affairs the gross liabilities amounted to £3,952, of which £3,777 was expected to rank, against assets of £1,289, or a deficiency of £2,488. Mr. John Draper, I.A., of Bradford, was appointed as trustee, and a committee of inspection was also nominated, comprising Mr. F. Bartlett (Messrs. F. Bartlett and Co.), Mr. Armstead Smith (Messrs. Smith & Croft), and Mr. Joe Dyson.

Sarkis Balthazar Sukiassian (otherwise known as B. Sukiassian), 12, Roxborough Avenue, Harrow-on-the-Hill, Middlesex, late 137, Cheapside, London, merchant.—The receiving order in this matter was made on March 21st on a creditor's petition. The statement of affairs shows liabilities of £5,516, while the assets are estimated to realise £1,397, or a deficiency of £4,120. Debtor attributes his failure to want of capital, depreciation of stock owing to falling markets, bad debts, and depression in trade. It appears that he is an Armenian who came to England in 1902, and for 2½ years was in the employ of a firm of shippers in Manchester. On August 20th, 1904, he commenced business on his own account as a shipper at 29, Minchull Street, Manchester, with about £500 borrowed from his father, who subsequently lent him further sums up to £4,000 or £5,000, which have not been repaid. He did practically no business from 1914 until after the Armistice in 1918, but continued to trade until September, 1922, when, owing to the loss by fire of £800 worth of cotton goods which he had sent to his father at Smyrna early in 1921, he gave up the business. Cotton goods supplied to him were sent by him to customers abroad through his bankers, who advanced him money on the bills of lading, but the customers will not now accept delivery of the goods owing to the fall in prices. About June, 1921, he commenced trading as an importer of electric incandescent lamps at 137, Cheapside, E.C., but an action was brought against him by a company for infringement of its patent, and he surrendered the lamps he then had in stock, worth about £200, paid about £25 costs, and discontinued the business in March, 1922. In June, 1922, he entered into partnership with another in an electrical business, the partner providing no capital, but this partnership was dissolved in January, 1923, and the stock and office furniture were sold. Debtor states further that whilst he was trading at Manchester he, in 1921, formed a company, of which 350 £1 shares were allotted to him in respect of goods which he supplied to the company. The business was not a success, and was closed down at the end of 1921.

Arthur Walter Curtis (44), electrician, "Rose Bank," Warwick Road, Copt Heath, Knowle.—At the Birmingham County Court (Bankruptcy Section) on May 10th, bankrupt, whose deficiency was stated to be £398, said, in reply to the Official Receiver, that in June, 1918, he commenced business on his own account with a capital of £50. A partnership was subsequently entered into, but it lasted only six weeks. He was engaged on small repairs until August, 1920, when he obtained an order for extensive work at a large house at Knowle. There was no contract, it being verbally understood that debtor should be paid for the material and labour as the work progressed. On completion, in February, 1921, a dispute arose as to the account, and he estimated that a loss of £150 was sustained. Debtor had been advised that, owing to the absence of documentary evidence, he would not be likely to succeed in his claim, and since then nothing had been done in the matter. The case was adjourned until June 13th.

J. G. MacMillan (Glasgow Electrical Supplies Co.), dealer in electrical supplies, 138, Bath Street, Glasgow.—Estates sequestrated by the Sheriff of Lanarkshire, May 8th. Meeting to elect trustee and commissioners, May 22nd, at the Faculty Hall, St. George's Place, Glasgow; a composition may be offered at the meeting. Agent, Mr. J. M. Sclater, 53, Bath Street, Glasgow.

G. J. C. Thorne and A. H. Thorne (Lawrence Electrical Trading Co.), electrical engineers, 159, High Street, Notting Hill Gate, W.8.—Receiving order made May 9th on debtors' own petition. First meeting, May 24th; public examination, June 26th; both at Carey Street, W.C.

S. G. Wilkinson, electrician, 76, High Street, Wembley.—Receiving order made May 7th on creditor's petition.

C. R. A. Chadfield, electrical engineer, 12, Nottingham Street, Melton Mowbray.—Last day for proofs for dividend May 26th. Trustee: Mr. E. Barlow, Official Receiver, 1, Berridge Street, Leicester.

G. W. Humphry (Humphry Electric Co.), electrical engineer, 24, Broad Quay, Bristol.—First and final dividend of 5½d. in the £, payable May 22nd at the Official Receiver's Office, 26, Baldwin Street, Bristol.

W. A. Davis, electrical engineer, late of 3, Coronation Street, Leeds.—Supplemental dividend of ½d. in the £, payable May 24th at the Official Receiver's Office, 24, Bond Street, Leeds.

Company Liquidations.—International Railophones, Ltd.—A meeting of creditors is called for May 25th at Prudential Buildings, Corporation Street, Birmingham. Particulars of claims to the liquidator, Mr. W. S. Turner, Prudential Buildings, by June 30th.

Watson's Electric Co., Ltd.—A meeting of members is called for June 12th at 6, Dowgate Hill, E.C., to hear an account of the winding up from the liquidator, Mr. A. H. Stephens.

Grimsby Electric Welding Co., Ltd.—A meeting of members is called for June 12th at the offices of H. Blanchard, Ltd., Humber Bank Fish Docks, Grimsby, to hear an account of the winding up from the liquidator, Mr. H. Blanchard.

Radio Installations, Ltd.—Winding up voluntarily. Liquidator, Mr. G. W. Askew, 14, St. Mary Axe, E.C. Meeting of creditors at the office of the liquidator, May 28th.

Scarborough Tramways Co.—A petition for the winding up has been presented to the High Court by Mr. H. W. Pulleyn, of 8, Coppergate, York, Mr. T. E. Pulleyn, 2, Feversham Terrace, York, and Mr. J. Pulleyn, 1, Spurriergate, York, and will be heard in London on May 29th.

I.T.E. Electric Co. (1907), Ltd.—A meeting of members is called for June 18th, at 9, Walbrook, E.C., to hear an account of the winding up from the Liquidator, Mr. D. H. Jeboult.

J. B. Midgley, Ltd.—Meeting of creditors May 24th, at 69, Broad Street Avenue, E.C. Particulars of claims to be sent by June 25th to the liquidator, Mr. A. A. Hall, 69, Broad Street Avenue.

Dissolutions of Partnership.—Rock Electrical Co., electrical contractors and engineers, 12a, Rock Place, St. James Street, Brighton.—Mr. S. E. I. Porter and Mr. L. Leavers have dissolved partnership. Mr. Porter will attend to debts and continue the business under the same style.

Wireless Supply Depot, Edith Walk, Great Malvern.—Mr. L. H. Mansell and Mr. C. A. Mortimer have dissolved partnership. Mr. Mansell will attend to debts and continue the business under the same style.

James Tate, manufacturing electrical engineers, Victory Works, East Parade, Bradford.—Mr. C. E. Jones and Mr. W. H. Wilkinson have dissolved partnership. Mr. Jones will attend to debts and continue the business under the same style.

Ellis & Mort, electrical engineers and electrical equipment factors, 50, Topping Street, Blackpool.—Mr. W. J. Ellis and Mr. A. Mort have dissolved partnership. Mr. Mort will attend to debts.

Private Arrangements.—Charles James Nicholls, 7, Park Street, Bridgend, electrical engineer.—A meeting of the creditors in this matter was held on May 10th at the offices of Messrs. Clarke, Dovey & Co., accountants and auditors, Cardiff, when the statement of affairs showed liabilities of £867. The assets totalled £435, or a deficiency of £432. It was reported that the debtor commenced business in September, 1920, with a capital of £40, while he had borrowed small sums from his wife. Books of account had been kept, and the debtor attributed his present position to want of capital and pressure by creditors. He desired to continue the business, and made an offer of a composition of 6s. 8d. in the £. After discussing the position it was decided that the debtor should be given time in which to find security for the payment of a composition of 10s. in the £ by three equal instalments at three, six, and nine months. A committee of inspection was appointed consisting of Mr. E. M. Lewis, Cardiff, and the representatives of The General Electric Co., and Simpson Baker & Co. The following are creditors:—

	£		£
Simpson, Baker & Co.	46	Pritchett & Gold	54
Cardiff Electrical & Wireless Supply Co.	10	Pope, S.	38
Electromotors, Ltd.	42	Simplex Conduits, Ltd.	19
General Electric Co., Ltd. ...	62	Siemens Bros. & Co., Ltd. ...	11
Lewis, E. M.	80	Watson, A.	70

The General Sign Co., Ltd., 39, Victoria Street, London, S.W., electric sign manufacturers.—In response to a circular letter issued by the secretary of the company a meeting of the creditors was held recently at Dashwood House, New Broad Street, E.C., for the purpose of receiving a statement of the company's affairs, and considering a proposal for a settlement of the accounts. A statement was presented which had been prepared by Messrs. Jackson, Taylor, Abernethy and Co., C.A., which disclosed liabilities of £1,439, of which £331 was due to preferential creditors, and £1,171 to the trade and sundry creditors. The assets were estimated to realise at break-up prices £565, or a deficiency of £874. It was stated that the company was formed some two or three years ago, and a great deal of the capital found was expended in establishing the business. The present position had been largely brought about through the ill-health of one of the directors, who had been unable to attend to the business. An offer had been received from another company to introduce fresh capital on certain conditions, and it was suggested that the creditors should accept 10s. in the £ on their claims. After a short discussion a resolution was passed expressing the opinion that the offer was one that should be accepted.

R. A. Beevor, trading as R. A. Beevor & Co., and as the Beaver Electrical Supply Co., 109, Regent Street, London, W. —The creditors interested herein were called together recently, at the offices of Messrs. James & Cowper, accountants, 4, Walbrook, London, E.C., when a statement of affairs was presented which showed liabilities of £4,886. The indebtedness to the trade was £1,511, while there were private creditors for £548, and a cash creditor for £2,060. The debtor's mother was also shown as a creditor for £766, and there was an overdraft at the bank of £1 3s. 2d. The assets were estimated to realise £520, from which had to be deducted £74 for preferential claims, leaving net assets of £445, or a deficiency of £4,441. The stock-in-trade (£379) consisted of lamps, inductances, batteries, Amplion loud speakers, &c. It was reported that the debtor commenced business in April, 1922, when he borrowed £60 from a friend, and he had since borrowed further sums from the same source. The friend was now a cash creditor for rather more than £2,000. It was believed that the friend would withdraw his claim, while it was also thought that the mother would stand aside in respect of her claim of £766. Eventually it was decided that the meeting should be adjourned in order to enable the debtor to submit an offer of a composition.

The adjourned meeting of the creditors was held on May 14th, when it was stated that a guaranteed dividend of 6s. 8d. in the £ could not be submitted, but the cash creditor was willing to stand aside if the matter was dealt with under a deed of assignment. After discussing the position a resolution was passed in favour of the matter being dealt with under a deed of assignment, with Mr. J. James as trustee, and a committee was also appointed consisting of Messrs. W. H. Lynas (Alfred Graham & Co.), E. Brinsdon (Brinsdon & Co.), and E. H. Hawkins (Poppleton, Appleby & Hawkins).

Trade Announcements.—Messrs. Berry's Electric, Ltd., ask us to remind the trade that they recently removed their Manchester House from King Street to 5, Deansgate (Touchbutton House), where they have now completed extensive showrooms for the display of their fuse switchgear, "Magicoal" fires, &c. The branch is under the management of Mr. A. Shelton.

Mr. F. Horsfal, electrician, of 51, Southgate, Elland (Yorks.), announces that he is retiring from business.

Mr. W. Hampton has opened showroom premises for electrical fittings at 1, Bridge Street, Stafford.

Owing to expanding business received by the Scottish branch of its repairs and spares service, the Runbaken Magneto Co., Ltd., has removed to larger premises at 367/369, St. Vincent Street, Glasgow. 'Phone: "Central 672."

The Imperial Engineering Co., of Wolverhampton, has appointed Mr. A. E. Luen, 121, Queen Street, Cardiff, as its agent for South Wales and district. He holds stocks of radiators, boiling rings, &c., at Cardiff and Swansea.

Mr. R. Carter, of 36, Sussex Place, Ashley Hill, Bristol, has been appointed sole representative for Bristol, South Wales, and South-West of England by Messrs. S. Bill & Co., Ltd., Birmingham, for "Botrade" switch- and fuse-gear.

Catalogues and Lists.—Messrs. Siebe, Gorman & Co., Ltd., 187, Westminster Bridge Road, S.E.1.—An illustrated folder advertising lead-hydrate storage batteries.

Messrs. Ward & Goldstone, Ltd., Frederick Road, Pendleton, Manchester.—Radio List No. 101, fully priced and illustrated; also a sample of chain-braided aerial wire.

Messrs. Borrowdale Bros., Durham Road, Sunderland.—An illustrated pamphlet describing electrically-operated percussive tools, grinders, polishers, &c.

Pullar's Electric Sign Co., Queen's Place, Brighton.—A priced catalogue containing illustrations in colour of artistic electric light fittings.

The Electric Depot, Ltd., 222, Corporation Street, Birmingham.—A descriptive pamphlet dealing with the "Cressall" battery-charging panel.

Messrs. Mansell & Hogan, Ltd., 15-17, Cecil Court, Charing Cross Road, W.C.2.—A price list of radio-telephony receiving sets, parts, and accessories.

Siemens & English Electric Lamp Co., Ltd., 38-39, Upper Thames Street, E.C.4.—Monthly Trade Price List No. 90, giving illustrated particulars of lighting fittings, electric lamps, fuses, switches, dry cells and accumulators, domestic appliances, &c.

Centrifugal Clutches, Ltd., 32, John William Street, Huddersfield.—An illustrated pamphlet containing descriptions and prices of various forms of centrifugal clutches.

Messrs. Ferranti, Ltd., 180, Fleet Street, E.C.4.—List Fa76, containing illustrated details and prices of non-magnetic cast-iron resistance grids, with time temperature-rise curves.

Ateliers de Constructions Electriques de Charleroi, 56, Victoria Street, S.W.1.—May list of dynamos and motors in stock.

Messrs. Matthews & Yates, Ltd., Cyclone Works, Swinton, near Manchester.—Two illustrated pamphlets describing "Cyclone" blowers, exhausters, fans, motors, oxy-acetylene welding plant, &c.

The Vincent Switchgear Manufacturing Co., Sampson Road North, Birmingham.—A fully-illustrated and priced catalogue of switch- and fuse-gear of various patterns.

The Consolidated Pneumatic Tool Co., Ltd., Egyptian House, 170, Piccadilly, W.1.—A supplementary sheet dealing with two sizes of "Little Giant" grinders and polishers.

Mr. Walter Balmford, "Electric House," Whittall Street, Birmingham.—A price list of "J. L." universal clips for fixing small cables and wires.

Swedish General Electric, Ltd., 5, Chancery Lane, W.C.2. —An illustrated brochure describing the design and construction of "Fuller" static transformers.

The Imperial Engineering Co., 56, Darlington Street, Wolverhampton.—A priced and illustrated pamphlet advertising boiling rings, kettles, irons, &c.

The Electric Heating Co., George Street, Croydon.—An illustrated and priced booklet giving particulars of irons, kettles, fires, &c., together with a list of trade discounts.

Electricians' Wages.—By an award of the Industrial Court, the No. 3 (North-Western) Area has been brought into line with the majority of other areas by the fixing of a basic rate for electricians, &c., independent of the district engineering rate. The basic rates per hour for Zones A, B and C, are now 11.75d., 11d., and 10.25d. respectively. The present "all-in" rates are 18.35d., 17.58d., and 16.79d. After August 1st the rates will be 17.86d., 17.10d., and 16.34d. per hour respectively.

For Sale.—Edinburgh Corporation Electricity Department has for disposal two 800-b.h.p. triple-expansion steam engines (one Belliss and one Howden); Assets Auction Co., Ltd., will sell by auction on May 24th, at 119-121, Newington Causeway, S.E., wireless material and electrical goods; the chief engineer, Scottish Command, Edinburgh, invites offers for surplus generating sets lying at the West Fenton Aerodrome, Drem, Haddington, N.B. (See our advertisement pages.)

Patent Application.—Application has been made for the restoration of Patent No. 24,841, of 1914, granted to the Allies Electric Lamp Co., Ltd., for "Improvements in machines for cutting the globes of electric incandescent lamps and the like."

Our Foreign Trade.—April Figures.—The following are the values of imports and exports of electrical goods and machinery during April, 1923:—

	April, 1923.	Inc. or dec.	4 months, 1923. Inc. or dec.
Imports—	£	£	£
Electrical goods and apparatus	225,563	+123,033	+ 284,581
Machinery	921,474	+269,191	+ 573,244
Exports—			
Electrical goods and apparatus	711,080	+116,989	+142,859
Machinery	3,708,884	−571,470	−4,217,772
Re-exports—			
Electrical goods and apparatus	8,102	− 25,760	− 50,970
Machinery	104,408	+ 9,974	+ 39,414

Home Counties District Industrial Council.—The annual meeting of the Council was held on May 9th. Mr. Alderman Wilkinson (Luton), who has been chairman of the Council since its inception in 1920, in opening the meeting said that he took that opportunity of placing on record the general spirit of goodwill and amicable relations which had throughout characterised the meetings, and the fact that their work for the past three years had built up a mutual understanding beween the two sides of the Council, which he was confident would serve them in good stead in the future. Mr. Alderman Wilkinson was unanimously re-elected chairman for the ensuing year, and Mr. I. J. Hayward (National Union of Enginemen, Firemen & Electrical Workers) vice-chairman. Mr. T. W. Cole (Employers' side) and Mr. M. T. Greenwell (Trade Union side) were appointed joint secretaries.

Recreation.—On Saturday last the Chloride Electrical Storage Co., Ltd., Football Team won the Silver Cup in the final of the Pendlebury Workshops' Competition. The team has played consistently throughout the competition, scoring 12 goals, and having only two scored against it. On the same day the cricket team opened the league season auspiciously by declaring at 120 runs with three wickets down, and had captured one wicket for three runs when rain stopped play.

The Machinery Users' Association.—The report of the Association for the year ended March 31st last, presented at the annual meeting on Wednesday, records a considerable amount of financial support for the Rating of Machinery Bill which the Association has promoted in Parliament. Practically the whole of the report deals with this Bill (mentioned in our issue of February 23rd, p. 293) and members are warned that independent action may prejudice their cases.

The above-mentioned Bill came before the House of Commons on May 11th. It was left to the free decision of the House, although the Minister of Health stated that the Government proposed to set up a Departmental Committee to consider the question. Sir D. Newton moved the rejection of the Bill, principally upon the ground of the difficulty in deciding whether plant was "fixed or attached." Mr. Cecil Wilson said that the introduction of electrical power had altered the whole position. The Bill proposed to tax the "raw material," *i.e.*, power station plant, but to exempt that which derived its strength from the "raw material." Other speakers took the view that those who installed secondary electrical plant should not be subject to rating on that plant. The Bill was read a second time by 177 votes to 75.

Private Telephone Installations in Holland.—The report of the Netherlands House Telephone Co., of The Hague, states that no appreciable change took place in 1922 in the unfavourable economic conditions which affected the company in 1921. Many customers either restricted their orders for private installations or postponed extensions, with the result that the total orders booked were less than in the preceding year. Orders, however, were received from State and municipal institutions, which were regarded as being of importance for the future. The accounts show a loss of 418,000 florins for the year, and for the first time it is impossible to pay any dividend on the 6 per cent. preference capital of 800,000 fl. The directors now recommend that the ordinary share capital should be reduced from 800,000 fl. to 200,000 fl., so as to permit of the extinction of the deficit and allow of further provision being made for depreciation.

Postal Reduction Opportunities.—The postal reductions which came into operation on Monday last will doubtless cause a considerable revival of postal publicity throughout the country. Electricity suppliers and contractors particularly should bear in mind that whereas formerly not more than one ounce of printed matter could be dispatched for a half-penny, 2 oz. can now be transmitted for the same amount; and an additional ounce is also allowed for the 1½d. letter rate. It is as wasteful to send out "half empty" envelopes as it is to send out half-filled lorries. Make every postage stamp carry its full load. The British Electrical Development Association has a very large number of envelope fillers which will enable electrical undertakings and firms to attain this object.

New French Company.—La Compagnie Francaise de Radiophonie is the name of a new company which has lately been formed in Paris (79, Boulevard Haussmann) with a capital of 80,000,000 fr.

Applications for British Trade Marks.—The following are included among the recent applications for British trade marks. Objections may be lodged within one month from the dates mentioned. In the case of foreign applications, the names and addresses of the British representatives are also given:—

Blublaze (lettering and design). No. 431,300. Class 6. Electric ignition timers for internal-combustion engines.—Blublaze Motor Specialities Corporation, 45, Seventh Avenue, Long Island City, N.Y., U.S.A. (Brewer & Son, 33, Chancery Lane, London, W.C.). May 9th, 1923.

Magnar. No. 433,013. Class 8. Rectifiers for alternating electric current.—The British Thomson-Houston Co., Ltd., Crown House, Aldwych, London, W.C. May 9th, 1923.

Electronette. No. 433,315. Class 8. Electric resistances, &c.—Carl Lindstrom Gesellschaft, 26, Schlesische Strasse, Berlin, S.O.33 (Haseltine, Lake & Co., 28, Southampton Buildings, Chancery Lane, London, W.C.). May 9th, 1923.

Burndept. No. 434,660. Class 8. Wireless telegraphic and telephonic instruments and apparatus.—Burndept, Ltd., Aerial Works, Blackheath, London, S.E. May 9th, 1923.

Trutone. No. 434,871. Class 8. Wireless telegraphic and telephonic instruments.—Joseph Richardson, trading as Richardsons, 24, St. John's Street, Deansgate, Manchester. May 9th, 1923.

Book Notices.—"The Spectroscope and its Uses in General Analytical Chemistry (pp. 208; figs. 98). London: Bailhière, Tindall & Cox. Price 8s. 6d. net. Since this work appeared some fifteen years ago great developments have taken place in the science of spectroscopy, particularly in its application to industrial processes. The work, which was designed as a link between general physics text-books and advanced works on spectroscopy, has, therefore, been considerably enlarged and re-written. The introductory chapters describe in some detail the nature of refraction and the construction of spectroscopes; a large number of particular types is dealt with. The refracting angle and refraction index of a prism and their measurement are then treated, and this chapter leads to the refractive indices of liquids, molecular refractive power, absorption, &c. Chapter IV deals with spectrum analysis and shows how the angular deviations recorded on the divided circle of a spectroscope are converted into wavelengths. The character of spectrum lines is then touched upon and this is followed by notes upon flame and arc spectra, vacuum tubes, incandescence, illuminants, fluorescence, &c. A large section is devoted to spectrography and the preparation of plates and other matters connected with this branch of the subject are explained. The work is concluded with a chapter on X-ray analysis, which reproduces results obtained by Dr. S. Lewis Judd, Sir W. Bragg, and others.

"Traction Motor Control (Direct Current)," by A. T. Dover, M.I.E.E. (Pp. 114; 40 figs). London: Sir Isaac Pitman & Co., Ltd. Price 2s. 6d. net.—The preface to this book, which is one of the publishers' "Technical Primer" series, states that its scope is confined to an elementary exposition of the principles involved in the control of tramcars, trains, and railless electric vehicles. Considerable attention has been given to the connection diagrams of multiple-unit systems, and these can be followed without difficulty, being of the simplest form. The control of railless vehicles is given a separate chapter, and the vehicles dealt with include industrial trucks and vans, as well as passenger cars and omnibuses. The last chapter deals with automatic multiple-unit control, and although brief, brings out the salient features of a number of methods.

"Propelling a Cargo Boat," by D. B. Morison, M.I.N.A. (52 pp.). London: Sports and Sportsmen, Ltd.—This is a well-illustrated reprint of an article by the managing director of Messrs. Richardsons, Westgarth & Co., Ltd. The employment of steam reciprocating engines and turbines and internal-combustion engines is dealt with in a popular manner, the last receiving the most attention. The greater part of the publication is devoted to illustrations of the products of the author's firm.

Circular No. 137 of the U.S. Bureau of Standards, "Auxiliary Condensers and Loading Coil used with Simple Home-made Radio Receiving Outfits." (Pp. 19.) Washington: Government Printing Office. Price 10 cents. This publication describes, as its title shows, the construction of condensers and a loading coil, particularly for use with the simple crystal receiving sets described in previous circulars.

The *Journal* of the Junior Institution of Engineers. Vol. XXXIII, Part VIII, May, 1923. London: Percival Marshall & Co. Price 2s.—In this issue a paper upon "The Instrument Equipment of Aeroplanes," by C. B. Clapham, B.Sc., is reproduced. In addition there are reports of visits and proceedings at local centres, as well as book reviews, &c.

"Electric Motors," by H. M. Hobart. 3rd Edition, Vol II, Chiefly concerning polyphase currents. Pp. xv+384; 378 figs. London: Sir Isaac Pitman & Sons, Ltd. 15s. net.

The *Transactions* of the South African Institute of Electrical Engineers. March, 1923. Johannesburg: The Institution. Price 2s.—The principal item in this issue is a paper entitled

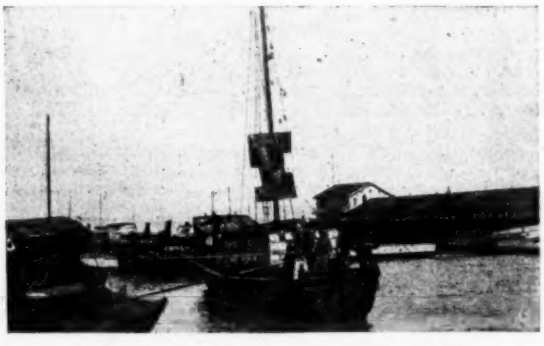
"Some Experiments in Continuous-Wave Transmission," by P. Machanik, M.Sc. Discussions on other papers are also included.

Annual Report for 1922 of the British Chamber of Commerce, Paris (incorp.). Paris, IXe: 6, Rue Halévy.

Journal of the Institution of Engineers (India). Vol. III. April, 1923. Calcutta: The Institution.

The Importance of Advertising for Tenders for Public Contracts.—Some discussion took place at last week's meeting of the Eastbourne Town Council regarding the placing of a contract for No. 14 feeder cable at £1,150 with the Craigpark Electric Cable Co. without the matter being advertised for tender. Councillor Buckland said that the Council was losing a lot of money by not advertising for tenders. Councillor Cave, in replying, said that tenders were invited from the best makers in the country. An amendment referring the matter back was moved by Councillor Buckland, who said that many expensive things were bought before ever a requisition was asked for by the committee. He added that tenders for things costing over £500 should be invited by advertisement. Alderman Simmons said that the electrical engineer had a very wide experience as to the firms that could be relied upon to supply the best material, and that was the reason that the firm named was chosen. According to the report in the local Press, Alderman Keay said the committee already knew the few makers who would contract for such work, and so they were written to and asked to send tenders. There was no doubt they could get cheaper cables from German firms, but they did not want these. They must go to the makers whose cables had stood the test. Councillor Marshall asked what was the use of the Council passing pious resolutions inviting tenders when they simply relied on the recommendation of an official. The amendment was defeated, only eight members voting for it. There was later a discussion regarding certain work required on the cooling tower. By a large majority the recommendation was referred back with the idea that the work should be held over as a job for the unemployed next winter.

The G.E.C. in the Far East.—In order to stimulate interest in China in matters electrical, the Hankow branch of the General Electric Co., Ltd., has fitted up a Chinese houseboat, shown in our illustration, as a travelling showroom, and is sending this on a long trip up the Han River. The houseboat is fitted with a G.E.C. country-house lighting set,



A G.E.C. Travelling Showroom in China.

and the boat will make a stop at every Chinese town passed during the journey, and demonstrations will be given.

A plenteous supply of publicity literature, printed in Chinese, is being taken on the journey, and one of the well-known "Osram" poster signs, with additional Chinese characters, will be noticed suspended from the mast in the illustration.

The British Empire Exhibition.—Special efforts are being made by the British Empire Exhibition authorities to have all branches of science adequately represented at Wembley next year, not only in the organised exhibits, but by means of conferences and discussions on scientific subjects. The main objects of the exhibition are to demonstrate the great resources of the British Empire in raw materials and the capacity and skill of our manufacturers in producing the highest class of goods in every branch of industry.

The exhibition will also show the high position we have attained in music, literature, painting and the arts. Husbandry, the cultivation of gardens and all the amenities of life will be illustrated. There will be lectures, conferences and kinemas dealing with all phases of our national life. An impression got abroad at one time that the exhibition would be visited mainly by millions of people interested in sport and amusements, but we are informed that great care has been taken that the sports and amusement sections of the exhibition shall not conflict with the sections devoted to more serious objects. The amusements will be confined to the Amusements Park, which will be a separate area of the exhibition, while sports and games will take place either in the stadium or in the swimming lakes.

Foreign Exhibitions.—Sweden.—The Jubilee Exhibition, commemorating the tercentennial anniversary of the foundation of Gothenburg, was opened, on May 8th, by the King of Sweden, in the presence of most of the foreign diplomatic representatives, including Sir Colville Barclay, British Minister to Sweden; Mr. Rowe, Vice-Chairman of the London County Council, and Colonel Vansittart Bowater, representing the City of London, were also present. The exhibition, which will last until September 30th, is intended to illustrate the historical development of Gothenburg and the present state of Swedish industry and commerce.—*Reuter* (Gothenburg).

The Acting Swedish Consul-General in London has sent us some printed matter relating to the above exhibition, the International Automobile Exhibition, the International Aero Exhibition, and the International Cities and Town Planning Exhibition, which are all being held at Gothenburg this summer. These booklets are excellently illustrated and are printed in English, giving a good idea of the scope and nature of the various exhibitions.

France.—An "*exposition régionale agricole*" is to be held at Montpellier, from May 19th to June 19th, in the course of which a congress will be called together to consider the best means for the electrification of rural districts. It is proposed to start a propaganda to stimulate the use of electricity by agriculturists, and find out the most economical means for the construction and working of rural networks. Furthermore, the exhibition will embrace all classes of electrical apparatus employed in agriculture. Those interested may obtain further information from the Président du Congres, Hôtel Saint Côme, Montpellier.

The "Hotpoint" School of Salesmanship.—The Hotpoint Electric Appliance Co., Ltd., has invited electrical firms in and around London to send members of the staffs to a course of six lectures which the company is arranging at its Berners Street showrooms. Various aspects of salesmanship will be treated, and at the end of the course an examination will be held and prizes awarded.

An Advertising Sub-Station.—The Midland Electric Corporation for Power Distribution, Ltd., has sent us a photograph of its Tipton (Staffs.) sub-station, taken from the L. & N.W. Railway main line. In large characters the words "For Electricity in the Black Country, apply" followed by the company's name and address, appear on the side wall. Immediately above is the phrase "Use Electricity," which is studded with electric lamps.

Import Duties on Wireless Apparatus.—The following appears in the last issue of the Monthly Bulletin of the British Chamber of Commerce in Paris: "In view of the numerous inquiries received at this Chamber with regard to the Customs duties payable in England on imported wireless apparatus, we beg to inform interested members that, besides wireless valves, the only parts of wireless receiving sets, as commonly imported into the United Kingdom, that are liable to the Key Industries duty of 33⅓ per cent. are variable condensers and any permanent magnets contained in headphones."

Local Exhibition.—Lynn.—At a recent meeting of the Town Council a resolution that an exhibition to encourage a more general use of electricity should be held, was adopted.

A Need in India.—An Indian correspondent, writing in the *Manchester Guardian Commercial*, says:—"India is rich in raw material, in things that grow. She has knowledge and power and arts and crafts, and her economic future depends on the wisdom or folly of her statesmen. Agriculture is her most vital industry, and it is here India must begin her industrial future. The production from the land could be doubled by organisation. . . . To-day there is little they can buy in the village itself. If India is to progress we must begin with the villages. We must make the village again a self-sufficing unit, and modernise it, bringing the meaning of civilisation home to the countryside. We must bring motive power and modern implements within the reach of the villages. India is rich in resources of water power, and coal and oil are there. Every district should have its electric power stations. The ploughman in the fields, the weaver in his hut, the blacksmith in his shop must be enabled to enjoy the fruits of scientific discovery. A Royal Commission on Agriculture would serve a good purpose in bringing to the focal point the economic conditions of the villages, and suggesting ways and means to organise capital for agriculture and allied industries."

Swedish Electrical Engineering Co-operation.—*Svenska Dagbladet* reports that three of the largest enterprises in the Swedish electrical engineering industry, Allmänna Svenska Elektriska Agtiebolaget, Nya Luth och Rosens Aktiebolaget, and Elektriska Aktiebolaget Eck, have bought the majority of shares in the next largest electrical engineering concern, Svenska Elektromekaniska Industriaktiebolaget of Helsingborg. According to the paper this action has been taken with the view of mitigating competition between the leading Swedish enterprises, which has caused considerable losses and has been more detrimental than foreign competition.—*Reuter's Trade Service* (Stockholm).

Canadian Electrical Affairs.—In the course of a report published in the *Board of Trade Journal*, H.M. Commissioner at Toronto quotes the following reference from the annual report of the Canadian General Electric Co., Ltd., Toronto: "During the year Marconi's Wireless Telegraph Co., Ltd., of Great Britain, which, with your company, owned the controlling interest in the Marconi Wireless Telegraph Co. of Canada, Ltd., intimated the necessity of a large expansion in the activities of the company, and that several millions of dollars would be required for this purpose. Your directors felt that as we were manufacturers, and not operators of public utilities, we should not join with such policy of expansion, although it seemed a necessary one from the standpoint of the Canadian Marconi Co., consequently negotiations were entered into with the British Co., and an agreement was concluded whereby we disposed of our stock-holdings to that company for cash and recovered certain manufacturing rights under our patents, which rights we had previously assigned to the Canadian Marconi Co. It will thus be seen that we have a real cash asset in our patent rights, yet we continue to carry them on our balance sheet at one dollar." The Canadian Westinghouse Co., Hamilton, Ontario, manufacturers of electrical equipment, in reporting recently on the past year's business, stated that it was not until about the third quarter of the year that inquiries began to result in noticeably increased volume of orders booked, and the shipments for the year did not, therefore, reflect to any large extent the advantage of improved business conditions. Throughout the year, however, the company was successful in securing such a volume of orders for the small class of apparatus as to justify the wisdom of its efforts in extending this portion of its business where the demand is inherently stable in comparison with the lines depending more directly on broad conditions of finance and trade.

Concentration in German Industry.—The Berlin correspondent of the *Manchester Guardian Commercial* says:—"Last year saw, on the whole, a halt in the movement towards concentration in German industry, which has produced the familiar huge amalgamations under the control of a few prominent captains of industry. These new concerns seem to have needed a breathing space in which to consolidate themselves. The movement has, however, recently made fresh advances. The Deutsche Petroleum A.G. has amalgamated with the Rutgers works, the great chemical concern allied with the A.E.G. The Schultheiss-Pathenhofer-Kahlmaum beer and brandy trust has united with the Austrian Hobe works. The great Westphalian iron and steel works, the Phœnix works of the Wolff group has formed a sales association with the Harpener Bergban mining concern. The Linke-Hoffmann group, originally a Breslau locomotive and wagon factory, has shown under its energetic management an astonishing capacity for absorption, still further increased through an alliance with the A.E.G. It has now brought under its control the Caro-Hegenscheidt mining company of Upper Silesia. The Caro-Hegenscheidt Co. owns considerable coal and ore deposits, with blast furnaces and steelworks more than sufficient, with the concerns already acquired by the Linke-Hoffmann-A.E.G. group, to cover the needs of these manufacturing concerns in coal, iron, and steel."

New Australian Companies.—The Australian Insulated Wire Co., Ltd., has been registered in Sydney with a capital of £25,000.

The U.S. Light & Heat Corporation (Australia), Ltd., has been registered in Sydney. The capital of the company is £50,000. Works are to be established at Ruchcutter's Bay, Sydney, for the manufacture of electric batteries and other products.—*Tenders.*

Unemployment.—The Ministry of Labour returns dated April 30th, show that the number of persons totally unemployed was 1,218,200, a reduction of 16,705 on the week, and of 267,678 during the year. Short-time workers numbered 58,300, an increase of about 1,400.

Vickers, Ltd., and Trade Conditions.—The report of the directors of Messrs. Vickers, Ltd., for 1922, says that the industrial conditions of the past year showed little variation from those of 1921. The company and its associates and subsidiaries received a fair share of what business there was going. This, however, was far below the productive capacity of the country, as was evidenced by the formidable number of unemployed. Under such conditions prices were necessarily extremely competitive, and only meagre profits, where profits could be earned, were to be expected. The unfortunate labour dispute in the first half-year naturally weighed heavily on the manufacturing and business community and worsened conditions which were already bad enough. Some slight improvement in the trade outlook became apparent towards the end of the year, and there are grounds for hoping that it may be continued.

The Boilermakers' Lock-out.—The publication of the figures in the boilermakers' ballot upon the question of the agreement relating to overtime and night-shift working in shipbuilding and repairing yards, showed that only a small percentage of the members of the Society voted. There was a majority of 10,090 in favour of repudiation on a total vote of about 19,000. The Society's membership is believed to be in the region of 90,000.

Whitsun Holidays.—The works of Messrs. Higgs Bros., Sands Pits, Birmingham, will be closed from this evening, Friday, May 18th, until the morning of Wednesday, May 23rd.

Electricity Supply Rifle League.—The following are the results of recent matches:—County Co. 571, West Ham 530; Hackney 536, West Ham 533; Metropolitan 575, St. James' 544; Metropolitan 581, West Ham 490; Shoreditch 580, St. James' 537; County 579, Central A 578; County 583, Central B 560; Metropolitan 587, Shoreditch 583; Metropolitan 582, Hackney 525. The Metropolitan Co. heads the list with 8 points.

LIGHTING AND POWER NOTES.

Aberdeen.—Street Lighting.—It is proposed to restore the pre-war lighting of the town at a cost of £5,000.

Accrington.—Year's Working.—The annual report on the working of the electricity undertaking for the year 1922-3 shows a net profit of £23,000. In the previous year there was a deficit of £3,400.

Bradford-on-Avon.—Special Order.—The Urban Council has consented to the application of the Western Electric Distributing Corporation, Ltd., for a Special Order to supply electricity in the urban area.

Bury.—Year's Working.—There was a net profit of £4,254 on the year's working of the electricity undertaking.

Caerphilly.—Inauguration of Supply.—The erection of the new transformer station, which was carried out by Messrs. Edwards & Armstrong at a cost of £10,000, has been completed, and the formal switching-on took place on May 9th. The electricity supply is obtained from the South Wales Power Co., and the charge for lighting is 9d. per kWh.

Canada.—Hydro-Electric Development.—The Shawinigan Water and Power Co. has placed a contract with the Dominion Engineering Works, Ltd., for four 30,000-h.p. propeller-type turbines, with equipment, for its new hydro-electric station on the St. Maurice River. Work on the erection of the station has already commenced, and it is anticipated that the scheme will be completed by June, 1924. When this station is completed the total capacity of the company's three stations on the St. Maurice River will be 500,000 h.p.

Continental.—Latvia.—The Government has under consideration the question of the erection of hydro-electric power stations at Kokenhusen (Duna) for the distribution of electricity in Lettonia, and is seeking the aid of foreign capital to carry out the scheme.

Crewe.—Extension of Supply.—The Town Council has had under consideration the question of extending its area of supply so as to include Haslington and Shavington, and the Clerks of these districts have been requested to furnish particulars as to the probable number of consumers.

Douglas (I. of M.).—Electricity Supply.—The first of two semi-Diesel 340-h.p. engines supplied by Messrs. Ruston and Hornsby, of Lincoln, was started up by the Electricity Committee on May 11th. The generators were supplied by the General Electric Co., and have a capacity of 226 kW.

Eastbourne.—Responsibility for Defective Lamps.—At a recent meeting of the Town Council a letter was read complaining that lamps installed in a house had burned out within a few weeks of commencement of use. The contractor who supplied them disclaimed liability, and the occupier of the house wished to know if any responsibility attached to the Council. The electrical engineer stated that the lamps were not of cheap foreign manufacture, and he could not understand their failure. It was the practice when anything of this nature happened for the local contractors or the Corporation to replace them at their own expense. He had received no complaint in this particular case. The engineer was asked to report further on the matter.

Glasgow.—Street Lighting.—The Lighting Committee has arranged with the Clyde Valley Electrical Power Co., Ltd., to supply current for street lighting on the Sandyhills housing estate, which is outside the Corporation's area of supply, at the same cost as for electricity supplied within the borough.

Lancashire.—Competing Applications.—The Lancashire Urban Councils' Association, at its conference at Fleetwood on May 11th, adopted a resolution that "The Electricity Commission and the Minister of Transport be respectfully informed that the Urban District Councils of Lancashire are strongly of opinion that, in the case of competing applications by a local authority and a power company, where the conditions are equally or more favourable to the consumer, the order should be granted to the local authority."

Lichfield.—Electricity Supply.—The Electricity Committee is negotiating with the Cannock Chase Colliery Co. for a supply of electricity to the district. It is proposed either to obtain a bulk supply or to request the colliery company to undertake the complete service.

London.—Change of System.—The Court of Common Council has given its consent to the City of London Electric Lighting Co.'s changing the frequency of its a.c. supply from 100 to 50 periods.

Lytham-St. Annes.—Loan.—The Town Council has applied to the Electricity Commissioners for sanction to the borrowing of £75,000 to meet expenditure on the electricity undertaking.

Marlborough.—Electricity Scheme.—As a result of negotiations with the authorities of Marlborough College, it is proposed that the Town Council shall install plant in the power station at the College for a supply of electricity to the town. The College authorities will provide the staff for running the station and will keep the plant in repair. A joint committee of management will be appointed by the Council and the College authorities.

Nelson.—Year's Working.—The annual report on the working of the electricity undertaking for the past year shows a net profit of £6,933.

Norden.—Electricity Supply.—The Electricity Committee has recommended the acceptance of the offer of the Rochdale Corporation to provide a supply of electricity for the district.

Northampton.—Extension of Supply.—The Northampton Electric Light and Power Co., Ltd., will shortly commence the work of laying the mains from the new power station in Northampton to Wellingborough, Rushden, Higham Ferrers, and Irthlingborough, with the object of supplying these towns direct from Northampton. It is hoped to have the work completed in a few months. When the connection with Northampton is completed, the power stations at Wellingborough and Rushden, which at present supply the four towns mentioned above, will be maintained as stand-by stations.

Price Reductions.—Reductions in the charges for electricity have been made in the following districts:—

Fleetwood.—Lighting: A reduction of ½d. per kWh, making a total reduction of 2d. per kWh in six months.

Nelson.—Lighting: A reduction of ½d. per kWh. Power: A reduction of ½d. per kWh.

Ainsworth and Bury (Lancashire Electric Power Co.).—Lighting: From 7d. to 6d. per kWh. Minimum quarterly payment: From 10s. to 7s. 6d..

Yarmouth.—Lighting: A reduction of 1d. per kWh.

Lowestoft.—Lighting: A reduction of 1d. per kWh, with 2½ per cent. discount. Heating: Reduction of 1d. per kWh. Power: Reduction of ½d. per kWh.

Wolverhampton.—Electricity for all purposes to be reduced from 75 per cent. to 60 per cent. above the pre-war rate.

Sheringham.—Electricity Supply.—The Urban District Council has been in negotiation with the Norwich Corporation for a supply of electricity. It is proposed that the latter authority should lay cables to Sheringham, and supply *en route* Coltishall, North Walsham, Mundesley, Overstrand, Cromer East, and West Runton, and possibly Wroxham. A conference of the various authorities concerned is to be held at Norwich on May 19th to consider the proposal.

Shropshire.—Hospital Lighting.—The Visiting Committee of the Salop Mental Hospital is considering the question of installing electric plant at the hospital at a cost of £5,000.

South Molton.—Electricity Supply.—The Town Council has decided to apply to the Electricity Commissioners for sanction to a scheme for the supply of electricity in the borough.

Stafford.—Electricity Supply.—The Town Council has approved the recommendation of the Electricity Committee that a l.p. main be laid for the supply of electricity to the Tillington area at a cost of about £1,500, exclusive of services; and that a new 1,000-kW rotary converter be installed at the power station at an estimated cost of £3,600.

Stretford.—Hire Charges Reduced.—In addition to the reduced prices for energy, mentioned in our last issue, we are informed that the following reductions in the charges for the hire of electric motors have also been made as from March 31st last:—Motors up to 4.5 h.p., war advance reduced from 33⅓ to 16⅔ per cent.; and above 4.5 h.p., from 50 to 25 per cent.

Sunderland.—Mains Extensions.—The Corporation is to carry out mains extensions at a cost of £3,966.

Swansea.—Year's Working.—The annual report on the working of the electricity undertaking for the past year shows a net profit of £19,365.

Wetherby and Collinham (Yorks.).—Electricity Supply.—The Parish Council has decided not to accept the offer of the Yorkshire Electric Power Co. to supply electricity to the district at 10d. per kWh, and has applied for authority to carry out its own scheme. It is proposed to generate electricity by water power.

Weymouth.—Loans.—The Town Council has applied to the Electricity Commissioners for sanction to loans of £9,199 for new generating plant, and £2,500 for services.

Wigan.—Electricity Supply.—The Electricity Committee has been in negotiation with a local colliery company regarding electricity supply, and the company has agreed to accept the Corporation's terms for a supply of 4,000,000 kWh per annum.

Wimbledon.—Purchase of Cookers.—The Electricity Committee has recommended that application be made to the Electricity Commissioners for sanction to a loan of £3,000 for the purchase of electric cookers during the next six months.

TRAMWAY AND RAILWAY NOTES.

Burnley.—Track Renewals.—The tramway track in Padiham Road is being renewed.

Continental.—Italy.—The Domodossola-Santa Maria-Maggiore-Locarno International Electric Railway will be opened in the beginning of July, and will accept passenger traffic from July 17th.—*The Times.*

Esthonia.—The Ministry of Communications has requested the managers of the railways to prepare a scheme for gradual electrification of the lines. Work in connection with the section between Reval and Römme is to be started during the present year.

Russia.—The Central Electrical Trust is reported to have entered into a contract with the Baku Soviet for the supply of the complete equipment for a tramway in Baku. The works include the building of two 500-kW sub-stations, the full equipment of a line of a total length of slightly over 11 miles, and the delivery of 40 tramcars. The Trust is now engaged in negotiations with the Erivan Executive Committee with regard to the reconstruction of a 800-kW hydro-electric station.

Spain.—The order for the 12 electric locomotives required for the equipment of the Pajares district railway has been placed in America. The line is expected to be ready for traffic by the summer.

Switzerland.—According to a report of the Federal Railway Administration, there is up to the present 357 km. of lines electrified, to which in 1923-4 will be added a further 235 km., so that by the autumn of 1924 one-third of the Federal network will be converted. The consequent saving of coal expected is 318,000 tons a year, or 45.4 per cent. of the total consumed by the Federal Railways in 1913.

Sweden.—The Railway Administration has proposed that the electrification of the Stockholm-Gothenburg Railway shall begin immediately and estimates the cost at 39 million kroner. —*Financier.*

Czecho-Slovakia.—According to a Railway Administration report, the question of electrifying the railways is under investigation. The electrification of railways in the neighbourhood of Prague will form the initial portion of the scheme, in conjunction with the building of the station at Prague. The route from Prague to Pilsen will be chosen for the trial works; here a number of power stations, including that of the Skadawerke, will be available to supply electrical energy. It is expected that the conversion will take three years to complete. If the trials are satisfactory the general electrification of the railways will be proceeded with.

Dearne Valley.—Tramway Scheme.—Work on the construction of the tramway system in the Dearne Valley was recently commenced. The estimated cost of the scheme, which is being carried out jointly by the municipalities of Wombwell, Wath-on-Dearne, Bolton-on-Dearne, and Thurnscoe is £230,000, and it will link up most of the towns and villages of the Dearne Valley with Barnsley.

Dundee.—Danger from Trolley Wires.—At a recent meeting of the Tramway Committee reference was made to the number of breaks in overhead trolley wires during the past few months, but the majority of the Committee expressed themselves as satisfied with the steps which were being taken to minimise the danger.

London.—L.C.C. Tramways.—Mr. Roger T. Smith, as arbitrator, has disallowed the claim made by the Electrical Trades Union, on behalf of controller repairers in the Council's employment, that these men be classed and paid as skilled workers; Mr. Smith holds them to be semi-skilled.

Tubes for North London.—The Ministry of Transport was recently asked to receive a deputation from representative bodies in the outer northern districts of London with regard to the construction or extension of an underground railway system for those districts. It was pointed out, however, that neither the Ministry of Transport nor the Ministry of Labour had any compulsory powers in this direction, and until a definite scheme was submitted by the companies no effective steps could be taken. There was, on this account, no good purpose to be served by any deputation on the matter.

Stoppage.—The normal train service on the City and South London Railway, between Moorgate and Clapham Common, which was interrupted owing to a subsidence during tunnelling operations, was restored on May 15th.

Leeds.—Serious Tramcar Accident.—On Saturday morning last a serious accident occurred at Churwell, Leeds, involving the death of six passengers and the injury of over thirty others. A car was proceeding from Morley to Leeds with about forty passengers. Upon reaching Churwell Hill, a steep gradient, the driver lost control, and the car, after rounding a curve, left the lines, crashed into a wall at the bottom of the inclined, and overturned. It is stated that the driver and con-

ductor and several passengers made a great effort to stop the car, but without success. The driver attributes the accident to the complete failure of the brakes.

Lowestoft.—Year's Working.—The report on the working of the tramway undertaking for the past year shows a total revenue of £22,024. Working expenses amounted to £18,311, leaving a gross profit of £3,713. Interest and sinking fund charges absorbed £5,296, leaving a net deficit of £1,583. In the previous year there was a deficit of £2,157. The Town Council has under consideration a proposal to introduce the railless-car system, owing to the heavy cost which would be involved by track renewals.

Lytham-St. Annes.—New Cars.—The Tramways Committee proposes to purchase ten additional cars.

Oldham.—Year's Working.—The working of the Corporation tramway undertaking has resulted in a net profit of £18,585 for the past year.

TELEGRAPH & TELEPHONE NOTES.

Belgium.—Strike.—The Government on May 12th issued a decree recalling to the Colours all railway, telegraph, telephone, and postal workers belonging to the 1915-22 classes. This measure was taken in consequence of strikes, and any man not answering the mobilisation call will be immediately dismissed and court-martialled. The Federation of Post Office Employés in the city and province of Antwerp voted a general strike on May 13th.—*Daily Mail.*

Italy.—New Cables.—An agreement has been come to between the Italian Government and a company for the laying of a number of submarine cables. One will be laid between Fiumicino, in Italy, and South America; another from the same point to the Azores, where it will link up with a cable to New York. The Compagnia dei Cavi will lay a third between Brindisi and Greece. In South America in the past few months a sum equal to 60,000,000 Italian lire has been raised by subscription for the first-named cable, and subscriptions continue to flow in. A syndicate of Italian bankers is arranging the financial side of the scheme.

Penang-Colombo Cable.—Laying Completed.—The laying of the new cable between Colombo and Penang has been completed. It is a high-speed one, and contains 630 lb. of copper to the mile. The *Colonia* left Colombo on March 3rd and arrived at her marks off Penang about eight days later after laying approximately 1,270 miles of cable at a speed of slightly under 7 knots. The cable at the deepest point is lying in three miles of water, and is the second direct cable connecting Penang with Colombo. Up-to-date instrument rooms and offices are being added to the buildings of the Eastern Extension Telegraph Co., and a subterranean cable is being laid towards Tanjong Bungah for use in connection with improvements which will take some time to complete.—*Eastern Engineering.*

The Telephone Service.—New Exchanges.—A new telephone exchange was opened on May 10th at Holly Lodge, New Wanstead, of the central battery type, which will have an immediate capacity for 1,500 subscribers' lines and 200 junction lines, and will have initially 800 subscribers' working lines and 160 working junction lines.—*Financial Times.*

On May 12th a new telephone exchange was opened at Waterloo, near Liverpool, to replace with up-to-date apparatus the old exchange. Subscribers, with few exceptions, retain their present numbers, and the new exchange will serve the same area as the old exchange.

Great Britain-Netherlands Service.—The Department of Overseas Trade has received a copy of an agreement between the British and Netherlands Governments regulating the telephone service between Great Britain and the Netherlands, which can be consulted by British firms interested on application to the Department of Overseas Trade (Shipping and Transport Section), 73, Basinghall Street, London, E.C.2.—*Board of Trade Journal.*

RADIO-BROADCASTING.

Denmark.—Wire-Radio Service.—The King opened a public wireless telephone service between Denmark and the Island of Bornholm, in the Baltic, on May 11th. The service is the first of this character in Europe, connection being possible with any ordinary telephone.

France.—Broadcasting.—As in London, so in Paris the question of the wireless broadcasting of concerts at the halls and plays at the theatres is causing some unrest, says the *Evening News*, and the effect on musicians and artistes is being keenly debated.

The alleged risk of damage by lightning to buildings in which radio apparatus is used is being considered by French insurance companies. *Onde Electrique* is asking its readers for opinions and evidence for or against the possible risk, with the characteristics of a safe earthing system. M. Marcel Cartault, a member of the Société des Amis de la T. S. F., is to summarise the communications received and arrange terms with the insurance companies.

Italy.—Radio Committee.—A Comitato Nazionale di Radiotelegrafia has been formed at Rome, under the auspices of the Reale Accademia di Lincei, with a view to giving a vigorous impulse to the study of wireless telegraphy in Italy. The Committee is formed of permanent and temporary members, the former including the heads of the various departments of the Post and Telegraph Administration and other eminent individuals. The president is Senator Prof. Corbino.

Manchuria.—Harbin Radio Station.—The radio station at Harbin, originally established by the Russians, has been redeemed by General Chang Tso-lin at a cost of $400,000, and is now under the charge of Mr. Liu Hang, graduate of the Chiao Tung University in Peking. Persons acquainted with the European languages are employed to translate the messages which are received daily from European countries. Press reports are issued, and there are a fairly large number of subscribers. To meet the demand of the Press, the station will establish a Far Eastern service to supply the public with news received from Russia. As Manchuria is a food-producing centre, the station will open daily communication with Shanghai in order to quote the price of foodstuffs in that port. The station is planning the installation of a wireless telephone service in Harbin and will supply a set of wireless telephone apparatus to its subscribers at a cost of between $70 and $80. Only official and Press messages are handled by the station, but arrangements are being made to receive private messages.

Radio-Broadcasting.—New Stations.—Two new broadcasting stations, one at Bournemouth and the other at Aberdeen, are to be opened by the British Broadcasting Co. During the next few weeks one of the first of a number of sub-stations to be put up in different parts of the country where "listening-in" is imperfect will be opened at Sheffield. A special land line is to be laid from the London station to Sheffield, where concerts will be transmitted by low-power apparatus.—*Evening News.*

On Sunday last an experiment in simultaneous broadcasting from all stations was carried out. An entertainment on the usual wave length was broadcast from the London station between 3 p.m. and 4 p.m., and re-broadcast from country stations, to which it was conveyed by land wire.—*Daily Mail.*

Negotiations Suspended.—On May 9th the Theatrical Managers' Association decided to break off negotiations with the British Broadcasting Co., to decline to give evidence before the Post Office Committee on broadcasting, and to do all in its power to prevent the broadcasting of plays by artistes employed, or likely to be employed, by it, says the *Daily Mail.* This decision was reached by the Joint Broadcasting Committee of the 14 organisations in the entertainment industry, after receiving the reports of its sub-committees. "We decided," said Mr. Walter Payne, chairman of the committee, "that if the Postmaster-General would not give us representation on the committee he has set up, we could no longer continue negotiations."

Russia.—New Radio Stations.—The Baltic Government Steamship Authority has given an order to the Radio Section (Weak Current) to install radio stations on 20 large steamers. The first installation was on the *Communist.*

The People's Roads Authority has made a contract with the Weak Current Trust to equip 25 receiving stations and nine receiving-sending stations on the Onega Sea, in Tuapse, and at other points in the Crimea and the Caucasus.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared in our advertisement pages.)*

OPEN.

Aberdare.—June 7th. Electricity and Tramways Department. One 3-ton end-tipping electric lorry and a motor-generator charging set and control gear. (See this issue.)

Australia.—Melbourne.—August 25th. Electricity Commissioners. 31 22,000-V transformers ranging from 750 to 15 kVA.

Newcastle (N.S.W.).—July 26th. City Council. H.p. switch and control gear, &c., for the electricity works.—*Reuter's Trade Service* (Melbourne).

Basingstoke.—May 24th. Board of Guardians. Wiring and fittings for electric lighting installation at the Institution. (May 11th.)

Barnes.—The Public Health Committee recommends that tenders be invited for an electrically-propelled dust-collecting van.

Belfast.—May 22nd. Electricity Department. Switchgear for sub-station, and transformers. (May 4th.)

Belgium.—May 23rd. Municipal authorities of Ulbeek (Province of Limbourg). Establishment of a l.p. electricity-distribution system in the towns of Ulbeek, Alken, and Wellen-Herten. Particulars (4 fr.) from M. Loewenthal, 19, Rue Faider, Brussels.

June 15th. La Députation Permanente de la Province du Limbourg, at Hasselt. Equipment of 30 transformer stations in certain villages in the province and for the supply of 30 static transformers. Particulars (12 fr.) from the Service Provincial d'Electricité, 27, Avenue Bamps, Hasselt.

May 23rd. Office de l'Electricité, 25, Rue de la Charité, Brussels. H.p. transformer station at Clabecq, in connection with the electrification of the Belgian State Railways.

Bishop Auckland.—May 26th. Waterworks Committee. Electric lighting of new filter house, West Mill waterworks, for Urban District Council. Waterworks manager, Town Hall Buildings.

Blackpool.—May 30th. Electricity Committee. One water-tube boiler, complete with stoker and auxiliaries. (See this issue.)

Crook.—June 4th. Urban District Council. Pole line, transformers, and switchgear in connection with the electric lighting scheme. (May 11th.)

Dublin.—May 24th. Great Northern Railway (Ireland). Stores for 6 months, including signalling materials, &c. (May 11th.)

Eccles.—May 22nd. Electricity Department. 1,300-kVA group of Scott-connected transformers. (May 11th.)

Falkirk.—Electricity Department. One 2,000-kW turbo-alternator, with condensing plant and accessories. (See this issue.)

India.—ALLAHABAD.—July 3rd. Public Health Department. Pumping plant, consisting of oil engines, generators and motors and centrifugal pumps at Fyzabad in connection with the water supply scheme. Executive engineer of the Second Division of the Public Health Department, Allahabad.

BOMBAY.—June 28th. Great Indian Peninsular Railway Co. Electrification of Bombay suburban lines. Motor bogie trucks and bonds. (See this issue.)

Limerick.—May 21st. Electricity Department. Three Diesel oil engines, direct-coupled to three d.c. generators. (May 11th.)

London.—METROPOLITAN ASYLUMS BOARD.—May 23rd. Installation of electric lighting in the administrative block, engineers' office block, and isolation ward block at the North-Western Fever Hospital, Lawn Road, Hampstead, N.W. (May 4th.)

ISLINGTON.—May 30th. Electricity Department. Plant for raising water from artesian well by compressed air lift, water-treating plant, h.p. and l.p. switchgear for sub-stations. (May 11th.)

L.C.C.—L.p. electric cables (including telephone and pilot cables) and relaying and jointing existing l.p. cables. (See this issue.)

FULHAM.—May 26th. Electricity Department. Six 200-kW air-cooled transformers. (See this issue.)

INDIA STORE DEPARTMENT.—June 8th. Electric cables. (See this issue.)

Luxembourg.—The municipal authorities of Luxembourg (Grand Duchy of Luxembourg) have invited tenders for the supply of 810 single- and 3-phase electricity meters.

Manchester.—May 29th. Electricity Committee. Twelve months' supply of cable. (May 4th.)

Newmill, Huddersfield. — May 21st. Urban District Council. Three-phase, 400-V switchboard, &c., 230 creosoted wood poles, 1,500 insulators, iron and wood arms, h.d. bare copper conductor, labour and erection. (See this issue.)

New Zealand.—DUNEDIN.—May 28th. City Council. Storage battery and distribution transformers.*

July 16th. Switchboard panels.*

Rumania. — June 1st. The Department of Overseas Trade is informed that a Rumanian municipality intends to place an order for one 600-h.p. Diesel engine and dynamo (220 V, d.c.), including cost of installation.*

South Africa.—PRETORIA.—June 27th. Irrigation Department. 50-h.p. hydro-electric plant for the Hartebeestpoost irrigation works.*

Spain.—MADRID.—June 5th. General Post Office. Telephone materials, carbons, &c. Tenders from British firms will be considered only in respect of such material as is not manufactured in Spain.*

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

CLOSED.

Aylesbury.—Town Council. Accepted:—

24 slot electricity meters (£87).—Ferranti, Ltd.
24 ordinary electricity meters (£42).—Electrical Apparatus Co., Ltd.
Cable.—Johnson & Phillips, Ltd.

Belgium.—The Belgian Post and Telegraph authorities, La Salle Madeleine, Brussels, have placed orders with the Ateliers de Constructions Electriques de Charleroi for various sizes of telephone cables up to 400 pairs, with boxes and accessories. Total contract, 2,500,000 fr. The municipal authorities of Schaerbeek have placed with the same company the order for 2,750 metres of 3-core, 6,600-V armoured cable and for 1,375 metres of telephone cable, &c., to which reference was made in our issue of April 20th.

Six tenders—five Belgian and one French—were submitted to the municipal authorities of Brussels last week for the supply of 37,870 metres of 3-phase cable and 21,600 metres of telephone cable, the lowest offer being that of the Ateliers de Constructions Electriques de Charleroi.

Seven tenders—four Belgian and one each French, Dutch, and British (Callender's Cable and Construction Co., Ltd., London)—were submitted last week to the municipal authorities of Schaerbeek, Brussels, for the supply of 7,000 metres of l.p. armoured cables. The lowest offer was that of H. Magenette, of Montigny-sur-Sambre.

Bury St. Edmunds.—Town Council. Accepted:—

Three months' supply of Manton best nutty slack (25s. 9d. per ton).
Service cable.—Callender's Cable and Construction Co., Ltd.

Cardiff.—Electricity Committee. Accepted:—

Switchgear for G.W.R. sub-station (£759).—Metropolitan-Vickers Electrical Co., Ltd.
Control panels for 1,500-kW rotary converter, Hayes sub-station (£295).—Ferguson, Pailin, Ltd.
Truck-type switchgear, Adelaide Street Docks sub-station (£545).—General Electric Co., Ltd.
Water-tube boiler and mechanical stoker (£6,375).—Babcock & Wilcox, Ltd.
Induced-draught plant (£855).—Davidson & Co., Ltd.
Self-supporting steel stack (£6/2).—Clayton & Shuttleworth, Ltd.

DURBAN.—The contract for a complete electro-pneumatic sewage lifting plant automatically controlled by float switchgear for the High Commissioner for the Union of South Africa has been placed with Messrs. Daniel Adamson & Co., Ltd.

Glasgow.—Tramways Committee. Recommended:—

Section pillar castings.—McDowall, Steven & Co., Ltd.
Steel doors for Whitevale sub-station.—R. C. Murray & Co.
Tramway poles.—Stewarts & Lloyds, Ltd.
Comptometer.—H. E. Robbins, Ltd.

Gas Committee. Recommended:—

One 30-b.h.p. motor clutch starter for the Provan gas works (£165).—Lancashire Dynamo Co.

Heywood.—Electricity and Tramways Committee. Accepted:—

Twelve months' supply of paper-insulated lead-covered and armoured cable.—W. T. Glover & Co., Ltd.

London.—L.C.C.—Highways Committee. 3,602 illuminated side service number indicators, complete:—

Benjamin Electric, Ltd. (Accepted.)	**£2,747**
Player & Mitchell	2,792
Tramway Supplies, Ltd.	2,927
Franco-British Electrical Co., Ltd.	3,332
Higgs & Hill, Ltd.	3,332
Brilliant Sign Co., Ltd.	3,557
Butlers, Ltd.	4,052
Rail and Road Car Equipment Co.	5,403
Williamson Kinematograph Co., Ltd.	5,808
G. A. Harvey & Co. (London), Ltd.	6,123
Gabriel & Co.	9,005
Equipment and Engineering Co.	10,626
Ditto (alternative)	10,806

The Committee has accepted the tender of the Benjamin Electric, Ltd., for the 3,602 indicators, together with 1,988 additional number plates, at a total cost of £2,846.

STOKE NEWINGTON.—Electric Lighting Committee.—Electric wiring and fitting of houses approved by the Council under its hire-purchase wiring scheme. The Committee recommends acceptance of the tenders of the following firms for a period of six months:—J. H. Golding, Linzell, Dickenson & Co., and Smith & Sons (Stoke Newington), Ltd.

North Woolwich.

38 "Ironsafe"-pattern switchboards for the control of the lighting and power supplies at the new shipbuilding works (£2,230).—Berry's Electric, Ltd.

Stourbridge.—Town Council. Accepted:—

Electrical fittings and controls for lighting the clocks at the Free Library buildings and the Town Hall.—Page & Bloomer.

Stowmarket.—Urban Council. Accepted:—

Motor, an indicator, and wiring work at the waterworks.—East Anglian Electricity, Ltd.

Taunton.—Electricity Committee. Recommended:—

New boiler (£1,660); reconstructing the chain grate of the mechanical stoker (£157).—Babcock & Wilcox, Ltd.

Weymouth.—Town Council. Accepted:—

Gas engine, with producer plant and generator, for the electricity works (£8,179).—Browett, Lindley & Co.

FORTHCOMING EVENTS.

Royal Institution of Great Britain.—Thursday, May 24th. At Albemarle Street, W. At 3 p.m. Lecture on "Engineering Problems Solved by Photo-elastic Methods," by Prof. E. G. Coker, F.R.S.

Physical Society of London.—Friday, May 25th. At the Imperial College of Science, South Kensington, S.W. At 5 p.m. Ordinary scientific meeting.

Illuminating Engineering Society.—Thursday, May 24th. At the Royal Society of Arts, John Street, Adelphi, W.C. At 7.45 p.m. Annual meeting. Paper on "The Use of Synchronously-Intermittent Light in Industry," by Dr. J. F. Crowley.

Institution of Electrical Engineers (London Students' Section).—Friday, May 25th. At the Institution, Victoria Embankment, S.W. At 7 p.m. Paper on "The Supply and Distribution of Electricity," by Mr. V. S. Manyam. Annual general meeting.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

We have to remind readers that Service Department inquiries should be accompanied by a stamped addressed envelope.

The makers or suppliers of the following devices are asked for:—

Asdic wireless direction finder.
Mercury-vapour-type letters for electrical signs.

NOTES.

Irish Free State.—The Free State Government proposes to establish a Patent Office in Dublin.

It is probable that, in response to a request of the Senate, a Commission will be appointed to inquire into the desirability of adopting the metric system, which, it is believed, would bring the State into closer touch with Continental countries.

Smoke Prevention.—The Public Control Committee of the London County Council has submitted a report in accordance with an instruction "to consider and report how far fog in London is caused by the pollution of the atmosphere due to preventable causes; whether by a larger use of electricity for power and other purposes the atmosphere of London might be improved; and whether any, and if so, what further powers are required to deal with the emission of smoke in London."

The Committee, while differentiating between fog and mist—the latter a carrier of fog—believes that if the smoke conditions of London and the surrounding area were mitigated there would be a considerable improvement. Both electricity and coal gas can be produced without giving rise to any serious emission of smoke. "Every gas cooker, gas engine, and gas-heated appliance, and every electric appliance performing any of the same offices represents a substitute for some kind of smoke-producing fire, and the use of these appliances should . . . . be encouraged." Particulars are given of the increased use of gas and electricity since the first part of the century. The conclusions of the Departmental Committee on Smoke and Noxious Vapours Abatement are given in full (*vide* Elec. Rev., December 30th, 1921, p. 898). The present law on the subject of smoke abatement is considered deficient, particularly as regards penalties, which it is considered should be progressive. It is admitted, however, that there has been a great improvement during the last twenty years.

The final recommendation of the Committee is: "That a copy of the report of the Public Control Committee on the subject of atmospheric pollution and fog prevention, submitted to the Council on May 15th, 1923, be forwarded to the Minister of Health, and that he be urged to introduce at an early date a measure dealing comprehensively with the whole subject of smoke prevention on the lines suggested by the Departmental Committee on Smoke and Noxious Vapours Abatement."

The agenda for the same meeting at which the above report was submitted contained the following motion by Sir Edgar Bonham-Carter: "That it be referred to the Housing Committee to consider and report, having regard to the recommendations of the Departmental Committee on Smoke and Noxious Vapour Abatement, whether it is practicable and advisable to adopt further methods in the Council's future building schemes to provide smokeless arrangements for warming rooms, supplying hot water, and for cooking; and, in particular, whether it is practicable and advisable to provide any of the Council's future tenement buildings with a central system of hot-water supply, whether for warming and domestic purposes, or for domestic purposes only."

Proceedings are to be taken by the Eccles authorities against the Manchester Electricity Committee for having failed to comply with a notice requiring the abatement of a nuisance caused by the emission of black smoke. Alderman Pearson (chairman of the committee) has explained that the chimney at the electricity works is too small for the proper combustion of the coal when the peak load is on, and the Electricity Commissioners will not allow expenditure at the Eccles works such as is required to obviate the trouble. The committee has had to spend £7,000 in the provision of machinery for transforming the three-phase current which the Lancashire Power Co. will supply, but the work will not be completed till October.

An "All-Electric" Canteen.—This month's *Industrial Welfare* contains an illustrated article describing the employés' canteen and dining rooms at the Dalmarnock power station, Glasgow. The magnitude of the installation may be gauged from the fact that the apparatus installed represents a total load of 85 kW. The main piece of apparatus is a three-suite "Falco" oven taking 15 kW. There are four soup and vegetable boilers aggregating 23 kW; a tea and coffee apparatus (8 kW); a four-pan fish suite (12 kW); pudding and cake mixer; boiling tables; hot cupboards; potato cleaner; hot-water apparatus, &c. The plant is capable of serving a much larger number of persons than those actually employed at the station, and meals are sent by an electric vehicle to the meter and instrument workshop, four miles distant. About 210 meals are served daily, and the employés state that the cooking is excellent. The cost of cooking a three-course meal is 1.1d. with electricity at 1d. per kWh. No doubt if the installation were worked to its full capacity this figure would be reduced considerably.

Electrical Journals.—In a paper read a short time ago by Mr. A. Gowans Whyte on "The Industry, the Press, and the Public" (reported in our issue of March 9th, p. 294), the author criticised the practice of manufacturers, trade associations, and other bodies, of issuing journals which encroached upon the field of the electrical Press proper.

Commenting upon this in the March issue of the *Metropolitan-Vickers Gazette*, a writer says that the right of a manufacturer to circularise interesting information having a bearing on his products cannot be questioned. "While it may occasionally be necessary to restrict the reprinting of an article for a short time, so far as this journal is concerned it is always ultimately available for reproduction or abstraction. This in part answers a further complaint that the manufacturing firms do not keep the Press supplied with information to the extent that they should."

Counter-criticism of the electrical journals is offered by the writer who, while admitting that they serve a useful purpose, thinks that their aims are so identical that these would be better served by an amalgamation. He concludes by saying: "They are all very good, and all very much alike."

A Large Gyroscope.—*The National Electragist* states that Elmer A. Sperry, the inventor of the gyroscope bearing his name, has built a steel "top" weighing 100 tons, 13 ft. in diameter, and driven by a 350-h.p. motor. This is to be installed in the *Hawkeye State* as a stabiliser for the vessel. The gyroscope revolves at a speed of 800 r.p.m., it takes two hours to run up to full speed, and once it has reached this speed it will run for 18 hours without motive power. The top is electrically connected to a small gyroscope, which responds to the least roll and communicates its motion or swing to the large top. In operation it will exert a downward pressure of 300 tons on one side of the ship and an equal upward pull on the other.

An Oil-Engine Test.—A standard 28-h.p. marine engine manufactured by the Parsons Motor Co., Ltd., of Southampton, having four cylinders, 4¼ in. bore x 6 in. stroke, and running at 850/900 r.p.m., was recently given a 72-hour running test. The test was carried out to demonstrate the suitability of this type of engine for full-power work over extended periods. No special preparations were made. The engine had just completed the usual four hours' official trial, and after a brief inspection of fuel strainers, &c., it was restarted, being direct coupled to a Froude dynamometer; the power was transmitted through a Parsons standard metal-to-metal clutch and means were provided to show the speed and total number of revolutions as well as the exact amount of fuel and lubricating oil consumed. The test was carried out under the supervision of the Admiralty Overseer. During the 72-hour period the engine was under constant observation and was untouched except for replenishment of fuel and lubricating oil, and no trouble of any sort was experienced. The run was equivalent to a non-stop full-power sea passage of about 720 miles. The total oil consumption was 195 gallons of fuel and 11 gallons of lubricating oil.

Appointments Vacant.—Meter tester, for the Torquay Corporation electricity department; assistant professor in electrical engineering department, for City and Guilds (Engineering) College, London; mains engineer (£335), for the Hastings Corporation electricity department; engineers to supervise the erection and starting to work of large capacity electric locomotives (£600); assistant engineer (£600), to supervise the erection of a mechanical equipment of the power station for the South African Railway electrification; engineer in charge of machinery, &c., at the County Hall (£250 + bonus = £377), for the L.C.C.; charge engineer (£354), for the Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board. (See our advertisement pages to-day.)

Electric Cooking for Welfare Centre.—The Maternity and Child Welfare Committee of the Shoreditch Borough Council has had under consideration the system of cooking to be adopted at its new Model Welfare Centre. From figures supplied by the Jackson Electric Stove Co., Ltd., and the Gas Light & Coke Co., Ltd., comparative estimates of the cost of cooking by electricity and gas have been prepared. These have as a basis the daily provision of 25 breakfasts, 150 dinners, 25 teas, and 25 suppers. The cost of apparatus and its installation is estimated at £605 for electricity and £422 for gas, but with electricity at 1½d. per kWh and gas at 3s. 10d. per 1,000 cu. ft., the daily cost is calculated at 6s. 3d. for electricity and 12s. for gas. Members of the Committee having visited establishments where cooking is done electrically, report that they "have been very much impressed with the cleanliness and general advantages of electricity for cooking purposes over gas." The Committee accordingly recommends that electric cooking be adopted at the Centre, and that the Ministry of Health be asked to approve the extra expenditure over and above £25,000 promised by the Carnegie United Kingdom Trustees, being "confident that the Ministry will concur with them in their contention that electricity will in the long run prove more economical and satisfactory in every way than gas."

(*Continued on page* 783.)

THE BUENOS AYRES WESTERN RAILWAY.

Electrification of the Suburban Lines.

On April 30th, 1923, the President of the Argentine Republic, Dr. Marcelo T. de Alvear, inaugurated an electric service on the suburban lines of the Buenos Ayres Western Railway (fig. 2), which has a mileage of 1,882, is one of the great British-owned systems in the Argentine, and extends from Buenos Ayres to the foot of the Andes. It is the oldest railway in the Argentine, having been inaugurated in 1857 and operated by the Government until July 1st, 1890, when it was purchased by the Buenos Ayres Western Railway Co.

Fig. 1.—The 25,000-kW Generating Station.

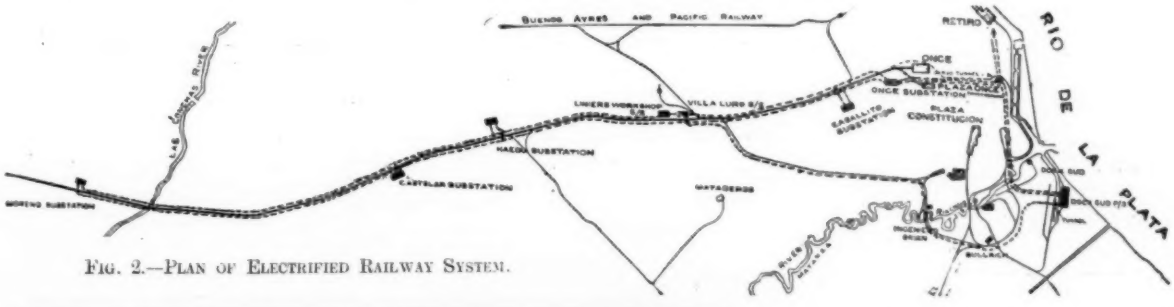


Fig. 2.—Plan of Electrified Railway System.

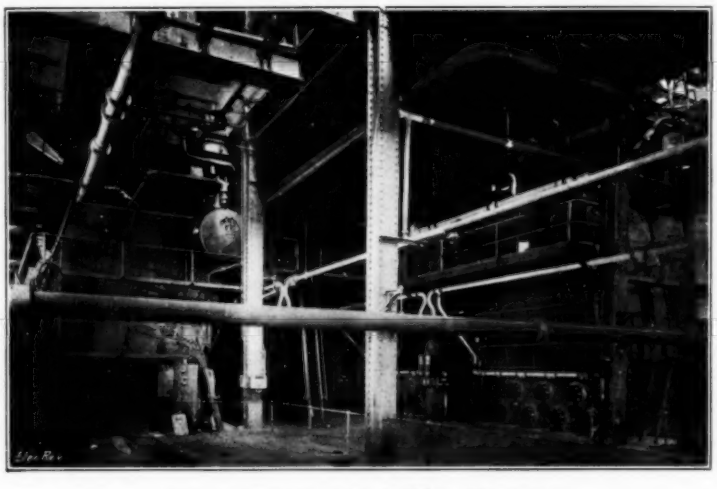


Fig. 3.—The B. & W. 20,000-lb. Boilers.

Freight traffic on the Western system consists mainly of wheat, maize, and general merchandise, whilst its passenger traffic during the 12 months ending June, 1922, amounted to 11,000,000; of which 9,000,000 were carried on the section serving the suburbs of Buenos Ayres. Of the four British-owned railways which have their headquarters in Buenos Ayres, the Central Argentine Railway, which serves the northern districts as far as Tigre River, commenced an electric service on the Tigre lines in 1916.* The railway termini are all some distance from the centre of the city, and are linked by an extensive tramway system. Urban traffic is also catered for by the Subterraneo of the Anglo-Argentine Tramways, an underground system. It was in order to facilitate trans-shipment of passengers that the railway arranged with the Anglo-Argentine Co. to establish a joint underground station beneath Plaza Once and to run the suburban trains from this station, which through service began on May 1st, 1923. Electrification work commenced in 1913 under the supervision of Messrs. Merz and McLellan, of Westminster, and of Messrs. Livesey, Son & Henderson, the company's consulting engineers, but the outbreak of the war resulted in the work being practically suspended, and it was not until October 16th, 1922, that the first electric passenger train was run between Once (high level) station and Castelar.

In addition to the passenger service, a portion of the freight service is handled electrically, the railway company having constructed a tunnel between Once and the port of Buenos Ayres, 5.1 kilometres long.

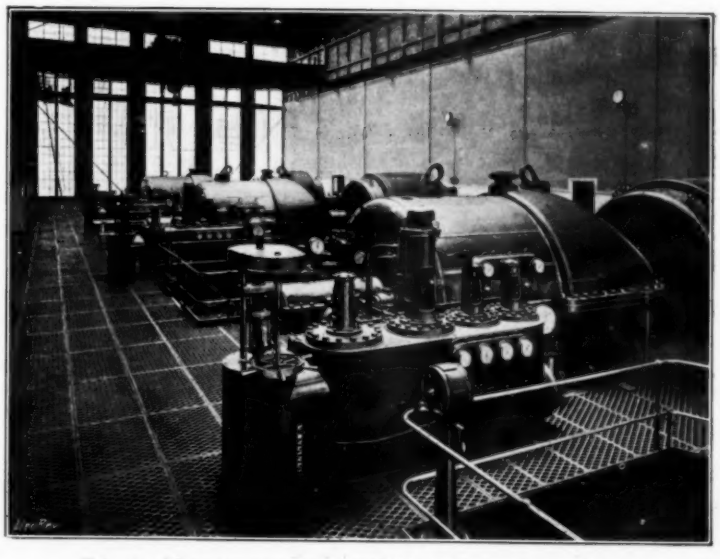


Fig. 4.—Metropolitan-Vickers 6,200-kW Turbo-generators.

* Elec. Rev., Oct. 18th, 1918; p. 363.

The complete electrification work includes a power station of 25,000-kW capacity, 72.5 miles of high-pressure cables, four traction sub-stations with 15,000 kW of converting plant, and the electrical equipment of 70 miles of single track. In addition, the supply of power and lighting calls for transforming plant to the extent of 7,000 kW, distributed in four static sub-stations and two of the traction sub-stations.

Three-phase power is generated at 20,000 volts, with a periodicity of 25 cycles, transmitted to sub-stations, converted to direct current at 800 volts, and supplied to the electric trains through a third rail. At the port and in goods sidings to be electrified in the future, overhead electrical equipment of the track has been installed.

Generating Station.—The power house (fig. 1) on the River Plate has been erected jointly by the Buenos Ayres Western and Great Southern Railways to supply the suburban lines of the Western Railway, the Western workshops at Liniers, the terminal station at Once, the Great Southern workshops at Banfield, and the terminal station at Constitucion. When the Southern Railway

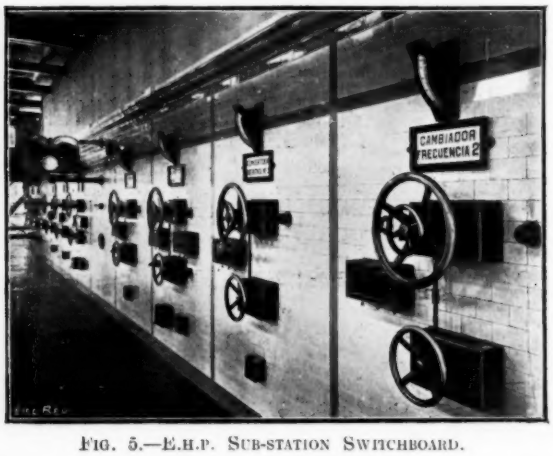


Fig. 5.—E.H.P. Sub-station Switchboard.

decides to electrify its suburban lines, the power station can be extended as required. The station is built on a concrete raft supported by over 1,500 ferro-concrete piles, the design having in view the extension of the station to 12 turbo-generator sets and four boiler houses. The boiler house contains the following principal plant:—Seven Babcock & Wilcox marine-type water-tube boilers, each having a normal evaporation of 20,000 lb. per hour, the working steam pressure being 210 lb. per sq. in. and the temperature 600 deg. F. The heating surface of each boiler is 4,170 sq. ft. and the grate area 98 sq. ft. Green economisers having 200 pipes each are provided, also seven "W. R." CO_2 indicators, ten Sirocco fans, two impulse turbine-driven centrifugal Weir feed pumps, each with a capacity of 175,000 lb. per hour, and two vertical reciprocating Woodeson feed pumps. Fig. 3 is a general view of the boiler house, the boilers being grouped in pairs, each having its own superheater and economiser.

One steel chimney with an induced-draught fan serves each pair of boilers, and forced draught is supplied to the furnaces by six fans in the basement. It was originally intended to burn coal, but recently the whole of the Underfeed stoker equipment has been replaced by the Babcock system of oil firing, with the necessary storage tanks, filters, and pumps. The combined efficiency of boilers and economisers is about 85 per cent. when either Welsh coal or Mexican oil is being burnt. For the storage of coal special wharfing and unloading arrangements were designed. Mild steel bunkers lined with armoured cement of 1,500-tons capacity were erected, so that the chutes discharged directly into hoppers in front of the boilers. With the intro-

Fig. 6.—Control Room.

duction of oil firing, however, arrangements had to be made for the storage of oil in two tanks of 100 tons capacity each, drawing their supply from the main deposit tanks of the Buenos Ayres Western Railway Co., which have a capacity of 8,000 tons each, so that under ordinary circumstances an ample supply of oil is ensured.

The ash-handling arrangements are of the suction type, and at present two exhausters of 60-h.p. each draw the ashes from the furnace pits through electrically-operated crushers to two bunkers arranged so that a railway truck can be run underneath to receive and remove the ashes. This ash-handling plant is at present out of service, but is retained together with the coal-firing apparatus ready to be used at relatively short notice should occasion arise.

The generating plant is arranged on the "unit" system, it being possible to start up any one of the turbo-alternators and to supply the main busbars and all the station auxiliaries. Further, the breakdown of anything comprised in one generating unit will not affect the operation of other sets. There are three turbines in the engine room (fig. 4), each set having its own steam-driven oil pump for use when starting up and shutting down, its own condenser, with air- and water-extraction pumps, and an independent circulating water pump. A self-excited exciter is coupled direct to the alternator shaft, and from the alternator leads are run direct to the "unit" transformer, which steps down the generated voltage from 2,500 to 440,

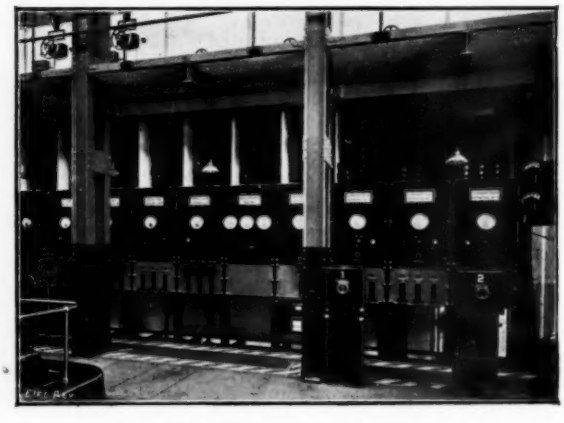


Fig. 7.—D.c. Sub-station Switchgear.

giving a supply to the "unit" distribution board, from which all units belonging to the generating set to which it belongs can be operated, whilst an alternative supply can be obtained from the distribution boards common to the whole of the station auxiliaries that are

fed from the main busbars of the station, the pressure being stepped down to 440 volts by two transformers.

The main leads of the alternator (copper strip 2½ sq. in. area) run to three single-phase transformers which step up the generated voltage to 20,000, at which pressure the power is supplied to the station busbars. The

Fig. 8.—A Sub-station.

arrangement of duplicate busbars has required somewhat elaborate interlocking of switchgear with the chamber doors.

The three 6,200-kW, 0.85 p.f., 2,500-volt, 25-cycle, Rateau impulse Metropolitan-Vickers turbo-alternators operate at a steam pressure of 200 lb. per sq. in., a vacuum of 1.5 in. of mercury, and a speed of 1,500 r.p.m. The Richardsons, Westgarth surface condensers have a cooling surface of 13,500 sq. ft., 10,000 gal. of water being needed per minute, giving an absolute pressure of 2.1 in. of mercury with 90,000 lb. of steam per hour each and cooling water at a temperature of 80 deg. F. The kinetic jet air extractors are coupled direct to the water-extraction pumps and driven by 42-b.h.p. 1,440-r.p.m. motors. The four Worthington vertical rotary water circulating pumps are driven by M.-V. 200-h.p. 480-r.p.m. motors, and are each capable of delivering 10,000 gal. per minute. The purified water, bilge, and emergency pumps are also of the Worthington vertical rotary type, driven by 16-h.p. motors at 1,450 r.p.m.

The generating station transformers are of the Metropolitan-Vickers, 3-phase, oil-immersed, oil- or air-cooled type; the eight 830-kVA main shell-type 2,500/20,000-V transformers are connected in mesh-star, the core-type 400-kVA, 2,500/440-V "unit" transformers in star-star, and the 1,250-kVA 20,000/440-V shell-type station transformers in mesh-star. Messrs. Siemens Bros.'

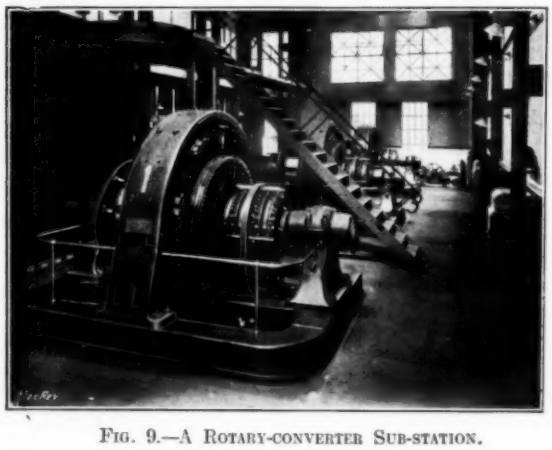


Fig. 9.—A Rotary-converter Sub-station.

Dynamo Works, Ltd., supplied the lighting motor-generators, each 440-V induction motor driving a 55-kW d.c. 110-V dynamo, and also a 10-kW battery-charging booster; two 250-Ah Tudor batteries provide current for the trip circuits, indicating lamps, &c., and also serve as a stand-by for the station lighting.

Between the turbine and the hand- or electrically-operated main exhaust valve, an atmospheric relief valve is fitted, and the speed of the machines can be controlled by hand or by electrical means from the switchboard in the control room. Oil is supplied under pressure to the bearings of the machines, whence it passes through strainers to the reservoir, and is pumped through the cooler.

The alternators are totally enclosed and ventilated by fans on the rotor, which draw air from the basement through wet-air filters and discharge it through a duct leading to a hollow wall between the engine room and transformer house to the roof. The transformer chambers are ventilated by natural circulation; the discharge of the air takes place up the hollow wall.

Each group of step-up transformers has its own oil cooler and circulating rotary pump driven by a 7-h.p., 440-volt, three-phase, squirrel-cage motor. The "unit" and station transformers are air cooled.

The condensing water is drawn from the South Dock and discharged into the River Plate. Revolving screens have been provided, being driven by 5-h.p. motors.

All main switching is carried out at 20,000 volts. All high-pressure switchgear is placed in moulded concrete cubicles. The current transformers are compound filled, ironclad, and of two types: one for mounting against a wall, the other for passing through the floors between the compartments of the panels; the latter save floor insulators and economise space. The potential transformers are oil-immersed and self-cooled. The

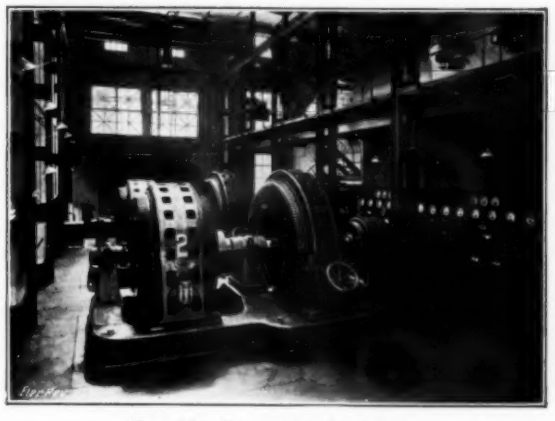


Fig. 10.—Frequency Changers.

whole of the high-pressure switchgear is remote-controlled from the control room (fig. 6).

In addition to the main switching operations, emergency panels are provided for each machine in the engine room, so that in case of emergency the engine driver, by pressing a button, can automatically open the main switches of the machine. Electrically-operated telegraphs maintain communication with the engine and boiler houses.

The protective gear used on the high-pressure apparatus in the power station and on the system is of the Merz-Price and Merz-Hunter types. Low-pressure panels, with oil switches, are equipped with overload trip switches and time-limit fuses. Vacuum and compressed-air apparatus is provided to assist in the cleaning of the high-pressure switchgear.

Cables.—The high-pressure transmission system consists of 20,000-volt underground feeders of the split-conductor type. A complete system of telephone cables is installed. The h.p. cables are 0.1 sq. in. concentric three-core, paper-insulated, lead-covered, single-wire-armoured, whilst the eight-pair and sixteen-pair telephone cables are dry-core, air-spaced, paper-insulated, lead-covered, single-wire-armoured and suitable for the use of superimposed circuits where necessary.

Where the cables pass over the transporter bridge, a special construction and support has been necessary to allow both for movement of the bridge due to traffic and also for expansion due to large temperature variations.

In all cases where the direct rays of the sun might reach the cables, sheet-iron protection has been provided.

A 50-way telephone exchange of the Sterling type is installed at the power station. All the cables were supplied and laid by W. T. Henley's Telegraph Works Co., Ltd.

Traction Sub-Stations.—The line at present electrified is served by four traction sub-stations situated at Once, Villa Luro, Castelar, and Moreno, or at km. 1, 9, 22, 5. and 37 respectively (fig. 8).

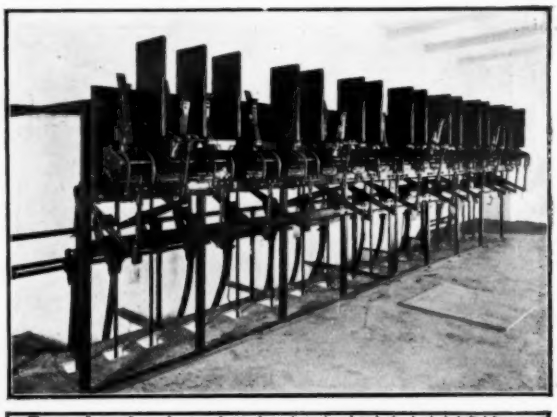
The principal plant in the traction sub-stations is as follows:—At the Once sub-station three rotary converters, at Villa Luro three, and at Castelar and Moreno two each, all of the English Electric compound-wound, commutating-pole, six-phase, diametrically-connected, 1,000-kW, 800-volt type. All the transformers are of the Berry single-phase, oil-immersed, naturally-cooled type.

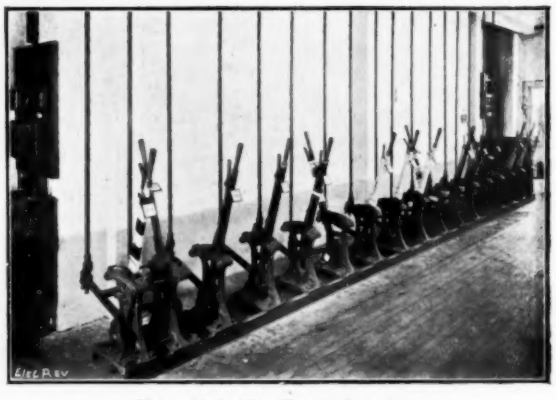
The h.p. switchgear is of the cellular moulded-concrete pattern; fig. 5 shows the operating floor of the h.p. switchgear. The different compartments are protected by screens interlocked with the isolating switches, and the busbars are sectioned and inter-connected by an oil

Fig. 11.—Overhead Equipment.

sectioning switch, the two halves of the bars being fed by different cables. The d.c. switchboard (fig. 7) is also of the cellular moulded-concrete type.

The rotary converters (fig. 9) are self-synchronising and are started from tappings on the l.p. side of the transformers by an oil-immersed controller. Provision is made for coupling negative boosters to the ends of the shafts when the traffic increases to such an extent that the drop in the track rails becomes greater than is desirable. The 387-kVA transformers are mesh-connected on the h.p. side, with tappings to compensate for variations in the supply voltage.



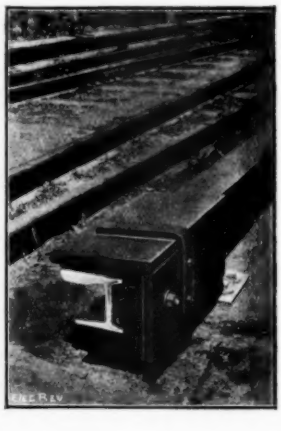


Figs. 14 & 15.—Track Switchgear.

The auxiliary equipment of each sub-station includes a bank of three 25-kVA, 20,000/440-V transformers, which supplies the Alley & McLellan air compressor used for cleaning, the Sturtevant ventilating fans, the 10-kVA, 440/110-V lighting transformer and the 5-kW Crompton motor-generator, which gives a d.c. supply at 110 volts for charging the 50-Ah Tudor battery used for the tripping and indicating circuits and the emergency lighting.

In the case of Once and Villa Luro, where 220-volt d.c. and 440-volt, 50-cycle a.c. are available, the auxiliary transformers have not been installed. In Villa Luro sub-station, centre-zero voltmeters connected to pilot wires running to the negative busbars of the four sub-stations assist the attendant to regulate the supply voltage at the various sub-stations so that each takes its due share of the load.

(To be concluded.)



Figs. 12 & 13.—An Electric Train and Conductor Rail.

NOTES.

(*Continued from page* 778).

The British Association.—Sir Ernest Rutherford, who succeeds Sir C. S. Sherrington as President, has selected as the subject of his address at the Liverpool meeting "The Electrical Structure of Matter." Among the presidents of sections are the following: mathematics and physics, Prof. J. C. M'Lennan, F.R.S. (Toronto); chemistry, Prof. F. G. Donnan, F.R.S.; economics, Sir W. H. Beveridge; engineering, Sir H. Fowler; psychology, Mr. C. Burt; and education, Prof. T. P. Nunn.

During the meeting a scientific exhibition will be open at the Central Technical School.

Fatalities.—The Paris correspondent of the *Manchester Guardian* reports that a fatal accident of an unusual nature occurred at Saint Denis. Two boys were cycling along a street where the violent rains had caused the roadway to sink, a stretch of water about 2 ft. deep barring their passage. The boys rode their machines straight into the pool; both immediately received a violent electric shock. The elder of the two succeeded in reaching the other side, but his companion fell senseless into the water. Passers-by endeavoured to come to his aid, but were unable to reach him by reason of the strength of the electric current. Finally firemen drew the boy from the water, but he was already dead. The explanation which is given of the accident is that the insulator of a post supporting an electric tramway wire was broken; this post stood in the water.

Mr. Thomas Wallwork, Blackburn electricity department mains superintendent, received terrible injuries last week. He was locating a fault at the Corporation distribution station when his right arm came in contact with a live wire, at 6,600 volts.

We regret to announce that Mr. Wallwork died on the 14th inst., at the Royal Infirmary, Blackburn. He was a Manchester man by birth, formerly associated with the firm of Kelvin & White, Glasgow, and he had been connected with the Blackburn electricity works for about 15 years. At the inquest, held by Mr. D. A. Haslewood, Arthur Lindsay Wallwork said his father was 45 years of age. On Tuesday, at 10 o'clock, his father was called out owing to a fault. He remained out all night, and at 9 a.m. the following morning the family were informed of the accident.

Dr. Gracey stated that deceased, when admitted to the infirmary, was suffering from shock and burns. He had a circular burn at the back of the head 6 in. in diameter, the right arm was completely amputated from the middle of the forearm, and there was a deep burn on the left side of the knee of the left leg. On Sunday the right arm was amputated at the shoulder owing to gangrene having developed, and death was due to shock following the injuries.

The Coroner adjourned the inquest until May 29th, so that H.M. Factory Inspector could have his electrical expert present. Mr. Briggs Marsden, on behalf of the Town Council and officials, expressed deep sympathy with Mrs. Wallwork and the family.

Underground Distribution in Rural Districts.—In an article contributed by two engineers of the Hydro-Electric Power Commission of Ontario to the Canadian *Electrical News*, particulars are given of the distribution of electricity in rural areas by means of underground cable. Over 150 miles of this cable has been laid by the Commission, and it is said to be operating successfully. It consists of a single No. 6 B. & S. copper conductor, rubber insulated and lead covered. The cable is laid in a trench at a depth of from 12 to 18 in., and is not protected by a duct or covering other than the replaced soil, except at such places as road crossings, where a creosoted plank is placed above the cable after the replacement of a few inches of the soil. The trench is made by a grading plough, of exceptional strength, drawn by a caterpillar tractor, and designed to turn a furrow 18 in. in depth. It is fitted with a coulter, which readily cuts through tree roots 4 in. in diameter. The tractor draws a carriage, upon which the cable drum is mounted, in addition to a scraper, which refills the trench. Cable joints are enclosed in lead sleeves, compound filled, and sealed with wiped joints to the cable sheath. At points where service to a consumer is required a wooden pole is erected and the cable is carried up this pole to a disconnecting pothead. Continuing the circuit along the highway, the cable is carried down the pole again from a second pothead. This method avoids a joint at the foot of the pole and the potheads form a useful means of opening the circuit for testing and other purposes.

Under conditions favourable to the installation of the cable the capital cost per mile will be less than for an overhead line. This applies to single-phase circuits only, where in general the lead sheath is used as the grounded conductor of the circuit. Excepting under conditions extremely unfavourable to overhead construction the cost of laying 3-phase circuits underground will exceed the cost of similar circuits overhead.

It is expected, however, that the cost of maintenance and operation and the rate of depreciation will be decidedly in favour of the underground system.

Nottingham's Super-Power Station.—After delay occasioned by exceptionally high floods, substantial progress is now being made with the preliminary work in connection with the new electric power station at North Wilford, near Nottingham, which will form one of the main factors in the scheme of electricity supply for the East Midlands recently sanctioned by the Commissioners. The site is contiguous to the river Trent, from which all the condensing water will be obtained, and it has also the advantage of being close to the Clifton Colliery, one of the largest in the Nottingham area. The first section of the station now under construction will be equipped with three 10,000-kW sets. In order to provide against danger from abnormally high floods, the floor line of the station has been fixed at 86 ft. above ordnance datum; this is 18 in. above the highest recorded flood level, that of October, 1875, when many of the low-lying areas in the "Meadows" district of Nottingham were submerged. To distribute the burden over the widest area, the grillage under the stanchions is composed of steel joists in two layers, so constructed as to form a network, the estimated weight on some of the stanchions being 400 tons. Rapid progress is being made with the construction of the boiler-house basement, the necessity for deep excavation being obviated by the fact that it is on a higher level than that of the turbine room. Considerable saving has been effected by utilising, for concreting purposes, the whole of the large quantities of gravel taken out during the excavations.

Although by reason of its level the land presented some difficulties, there will be the compensating advantage in connection with the site of presenting facilities for tipping on to it abundant quantities of ashes from the power station, thus obviating a considerable expense. It is hoped to have the plant completed and in operation some time next year. In the meantime, to meet the city's increasing demand for electricity, a temporary station has been erected, in which a couple of 2,000-kW sets have been installed, and from which electricity has been supplied for the past six months. Substantial reductions upon the present heavy charges for electricity in Nottingham are being looked forward to when the new generating station has been for some time in operation.

Stimulation of Plant Growth.—Ripe strawberries have arrived at Covent Garden, but it is quite probable that London's first supply will arrive even earlier in future. The International Institute of Agriculture has been experimenting with artificial "suns" in the shape of electric lamps, and it was found that strawberry plants under electric light yielded fine fruit in March, four weeks ahead of the usual time. Investigations not yet completed will indicate the best coloured lights and the maximum strength to be used to gain the best results. Vegetables of different kinds have been forced very successfully by this process. Indeed, it has been found, in the case of lettuces, that the forced plants are superior to the daylight ones.—*Evening News.*

The Structure of Alloys.—The thirteenth annual May Lecture of the Institute of Metals was delivered on May 2nd by Dr. W. Rosenhain, F.R.S., of the National Physical Laboratory.

Referring to the great accumulation of facts regarding the properties and micro-structure of alloys which have been forthcoming in recent years, the lecturer said that the time had arrived when it was most desirable that there should be found a key to this maze of knowledge in the form of a general theory that would link together the mass of facts into a homogeneous whole. Such a theory he attempted to put forward, basing it upon the intimate knowledge of crystal structure which had recently been acquired by means of the application of X-rays to the study of the arrangement of atoms in crystals. The crystal structures found in pure metals became modified in the case of alloys, particularly in those called solid solutions, where a second kind of atom, the atom of the alloying element, entered into the structure of the crystal and produced in it certain minute changes. With regard to such changes the lecturer put forward two simple principles, and was then able to show a striking series of inferences from his theory, which accorded closely with a large number of experimental facts. Connections between various series of properties in metals and their alloys were established which had not formerly been recognised, such as the relation between hardness and alloying power. Especially important is the connection between the minute distortion of crystal structure which occurs in alloys and their behaviour on melting and freezing, while such phenomena as plasticity, diffusion, and others fell easily into line with the same type of explanation. Most important of all, perhaps, is the fact that this new theory of alloy structure affords a ready explanation of the electrical properties of metals and alloys and the changes of those properties when the metal is heated or cooled. These explanations cover the mysterious phenomena of super-conductivity found in many metals when cooled nearly to the absolute zero of temperature.

Report upon Railway Accident.—Lt.-Col. A. H. L. Mount, reporting upon an accident at Cardiff (G.W. Railway) on February 26th, when a passenger train ran into the rear of another, stationary, train, attributes the occurrence to the forgetfulness of a signalman. The scene of the accident is approached *via* a curve which obstructs the view of the men on the footplate, and Col. Mount thinks that track circuiting with the usual locking would afford an additional safeguard at this place.

A Novel Hydro-electric Installation.—An engineering problem of more than ordinary interest has been worked out by the Pelton Water Wheel Company's Atlantic Department, in a contract just awarded for new hydraulic equipment by the City of Manizales, Republic of Colombia. This little city of the high Andes is more than a hundred miles from the railroad, and designs for a complete 500-h.p. installation have had to be worked out in sectional form to permit transportation by wagon, mule, and aerial tramway over the mountain passes, through some of the wildest country in South America. The mountain torrent supplying power for the Manizales municipal light station is strongly impregnated with sulphuric acid. This has been traced to a sub-surface flow through a stratum of volcanic rock, extending far up the slopes above the city. So far as is known, the Manizales plant is the only one in the world which runs on dilute sulphuric acid. The Pelton wheel design, consequently, had to be worked out on a basis permitting the use of bronze, brass, and Monel metal, instead of steel, at every point that would be exposed to the water. This was successfully accomplished, as was the companion task of sectionalising the entire equipment for transportation in small pieces and assembling on the spot, without prejudice to the strength or efficiency of the whole installation. The turbine, except for these features, is a standard Pelton impulse wheel of 500 h.p. It will work on an effective head of 250 ft., and will be direct-connected to a General Electric 350-kVA, 60-cycle, three-phase generator, from which the current will be distributed over the existing lines of the Manizales lighting system.

The entire hydraulic installation and all auxiliaries will be built in the I. P. Morris Department shops of the William Cramp & Sons' Ship and Engine Building Company, at Philadelphia, the Pelton Water Wheel Company being one of the companies of the Cramp organisation. The Manizales plant is located near the bottom of a deep canyon, and can only be reached directly by aerial tramway. When this tramway journey has been completed, it will still be necessary to lower the machinery down the slope of the gorge on a skidway to the point where it will finally be put in commission.

Educational.—B.E.A.M.A. Scholarships. — The British Electrical and Allied Manufacturers' Association directs attention to the fact that, in furtherance of technical education, it grants annually, to properly qualified candidates of British birth engaged in engineering works, ten scholarships, each of the value of £100, in addition to the payment of college fees. The last date for receipt of applications is June 1st. Forms and full particulars may be obtained by writing to the Secretary, The B.E.A.M.A., 36, Kingsway, W.C.2.

The Board of Education is arranging a series of short courses for teachers in technical and evening schools during the coming summer. Courses in engineering science and electrical engineering will be held at Oxford and Birmingham. At the former university courses of lectures will be delivered by Prof. F. C. Lea, D.Sc., Dr. W. E. Fisher, Prof. W. M. Thornton, D.Sc., and Mr. W. H. N. James, and it is hoped that a number of prominent men will give addresses and lectures. In Birmingham the work will be under the direction of Prof. Burstall, M.A., and Prof. Wm. Cramp, D.Sc., assisted by members of the university staff. Applications for attendance at these courses must be made not later than June 1st on Form 106e. U. Full particulars are given in Form 105e. U., which is obtainable from the Board.

A Broadcasting Problem.—We have received the following from a correspondent: "A few days ago some of the daily papers contained fragmentary allusions to an interesting wireless phenomenon, which, up to the present, has not been given a wholly acceptable explanation. Mr. D. H. Bloomer, of Warley Woods, Birmingham, who owns a three-valve set, had been listening to the local broadcasting station when he heard in the telephones a voice which he recognised as that of the lady next door, where a simple crystal set is installed. 'I ought to be frying some fish now, but I'm not,' was the remark which Mr. Bloomer heard. He immediately left his set and found the lady in the act of putting down the telephones. She had made the remark while wearing them.

"It was presumed that her voice, impinging upon the telephone diaphragms, became incorporated in some way with an oscillating current in the set, which caused it to be radiated from the aerial, which is about 30 ft. away from, and approximately parallel to Mr. Bloomer's aerial. It is not clear, however, from what source the current could have been supplied. The idea of a crystal-detector circuit being made to carry oscillatory currents of radio frequency has been hitherto deemed absurd, yet the indications in this phenomenon seem to point to the conclusion that such a state of things must have obtained when the voice was radiated. Transmission from the crystal set can be repeated at will, and by speaking near the 'phones, a person can be clearly heard on Mr Bloomer's loudspeaker even when the Birmingham station is being received.

"The first suggestion was that earth currents might be responsible, the two sets being connected to the water main. In that case the voice would not be radiated at all but merely conveyed from set to set along the lead piping. The impact of the sound waves upon the telephone diaphragms would be sufficient to set up variations in the current flowing in the magnets, and in this way the voice would be incorporated. The suggestion seemed feasible enough until the earth connection on the crystal set was removed. Results were still the same. The earth lead from the valve set was taken off and again there was reception. Not until the earth leads of both sets were removed at the same time did reception cease, but this was only to be expected. It was thought then that radiation from Mr. Bloomer's aerial might be energising that of the crystal set and thus setting up re-radiation, which would carry the voice. But the valve set was carefully adjusted so that oscillation could not be detected, and radiation, if any, must therefore have been negligible—and reception was quite unaffected.

"Yet a third suggestion was that the crystal set was being heterodyned and made to radiate by the powerful waves of the broadcasting stations. This was quickly discountenanced, for transmission was accomplished when all the broadcasting had closed down. The whole thing awaits solution, and presents a fascinating puzzle to wireless amateurs. It would be interesting to know if similar results have been noticed elsewhere, and if so, over what distance they have been recorded."

Patents in the Irish Free State.—The Institute of Patentees points out that considerable anxiety has been felt in connection with patents in the Irish Free State, and states that:—

1. Pending legislation, which is being considered, dealing with patents, trade marks, and designs in the Free State, no action is necessary with regard to patents, &c., granted or approved before December 6th, 1922.

2. Where applications have been lodged, but a decision was not given by the Patent Office before December 6th, 1922, particulars should be furnished to the Ministry of Industry and Commerce (Department of Trade and Shipping), Dublin.

3. Applications arising after December 6th, 1922, should be addressed to the above-named Ministry.

In connection with section 3, applications are received, in the first instance, and their receipt is duly noted without payment of fees. The scale of fees requisite in such cases will be notified to applicants before the applications are finally dealt with.

Electricity in Agriculture.—The difficulty which is experienced in this country in giving a supply of electricity to farmers, on account of the scattered nature of the load, is exercising electrical engineers in other countries also. As the *Electrical World* points out in a recent issue, the labour-saving problem is as acute in the agricultural industry as in other industries, but whereas electricity has been able to help the latter, it has not yet been possible to bring it to the door of the farmer economically on account of the small use of energy on the farm compared with the cost of the service. If the problem can be solved and the use of electricity on the farm can be properly developed, American "agricultural engineers" believe that the result will be a real revolution in agricultural production methods. With labour costs constantly rising and living conditions on an ascending plane, the farmer, like the manufacturer, must "increase the productive ability of the human worker by taking from him the tasks that mechanical equipment can accomplish much more economically, so that he can devote his time to keeping machines at work."

INSTITUTION NOTES.

Institution of Electrical Engineers.—Faraday Medal.—On May 10th, in the presence of a large attendance of members, representatives of the various institutions and societies, and a number of distinguished guests, the presentation of the Faraday Medal, the second award of the highest honour it is in the power of the Institution to bestow, was made to Sir C. Parsons. Mr. J. S. Highfield, Dr. S. Z. de Ferranti, and Mr. F. Gill made short speeches, and after receiving the medal from the hands of the president, Sir Charles briefly acknowledged the presentation.

Dr. J. A. Fleming, F.R.S., then delivered the 14th Kelvin lecture, which we hope to publish in due course.

Conversazione.—The annual conversazione will be held on the evening of June 28th at the Natural History Museum, South Kensington.

Junior Institution of Engineers.—On Thursday last week, at the Café Monico, London, the Institution held its annual dinner; the president, Capt. H. Riall Sankey, C.B., C.B.E., R.E. (retd.), was in the chair, and was supported by Messrs. W. J. Tennant (vice-president), Mr. H. V. Pointon (chairman), and several past chairmen, whilst the guests included Sir J. Fortescue Flannery, Bart. (president designate), Sir John E Thornycroft, K.B.E., Mr. Basil Mott, C.B., Mr. E. Fiander Etchells, Lieut.-Col. C. E. P. Sankey, D.S.O., Major W. G. Wilson, and other prominent engineers.

After the loyal toast, Mr. Etchells (president of the Institution of Structural Engineers) proposed "The Institution" in a racy speech, in the course of which he showed that "informal meetings" of young engineers were first held as long ago as 1771, and that from them had sprung not only the

"Juniors," but also the Institution of Civil Engineers itself. Engineering was safe in the hands of the young men, and theirs was one of the "livest" institutions.

Mr. H. V. Pointon responded, expressing gratification at the manner in which the innovations introduced by the Junior Institution had been taken up by other Institutions. Their wish was to cater for the young man in every branch of the profession.

Proposing "Modern Practice in Heat Engines," Sir John Thornycroft paid a tribute to the valuable work done in this connection by the president, and Capt. Sankey, in responding, stated that a committee of mechanical and marine engineers and naval architects was about to carry out extensive tests on marine engines. The report of the Institution of Civil Engineers on engine and boiler trials, which had fallen flat because the prospective users had not been taken into counsel, was being revised and extended to cover internal-combustion engines; six panels were at work drawing up the test sheets.

Mr. W. J. Tennant proposed "Our Guests," recalling experiences of the early days of high-speed engines, and remarked that the Junior Institution was in favour with the leaders of the profession. Sir Fortescue Flannery responded, emphasising the object of the engineer—to accomplish something for the sake of the work; if they loved their work and sought to excel, they would reap the joy of achievement. The spirit of co-operation and fraternity amongst engineers of all kinds ought to be developed. Lieut.-Col. Sankey also briefly responded.

Lastly, Mr. C. O. Mourant (vice-chairman) proposed "The Chairman," and Capt. Sankey acknowledged the compliment.

Musical items were admirably rendered by the London Glee Singers and Miss Joyce Flawn, who also acted as accompanist, and the function was very successful.

Association of Teachers in Technical Institutions.—The annual conference of the Association will be held at Leicester from Saturday, May 19th, to Wednesday, May 23rd. The new president, Mr. W. R. Bower, will deliver an address, and Lord Eustace Percy, M.P., Parliamentary Secretary to the Board of Education, will give an address; the rules will be amended, and resolutions calling for the correlation of technical education with other branches of educational work, and deploring the delay in the development of day continuation schools, will be considered.

Institution of Civil Engineers.—In the "James Forrest" lecture which he delivered on May 4th, Sir Richard Glazebrook, K.C.B., F.R.S., dealt with "The Interdependence of Abstract Science and Engineering," which was also the subject of the first lecture, delivered by Sir William Anderson 30 years ago. Sir Richard reviewed the progress that had been made in the interval, referring especially to the development of facilities for scientific training, to the appreciation expressed by workers for such training, the work of the Universities, the formation and extension of the National Physical Laboratory, the establishment of the Department of Scientific and Industrial Research, the functions of works research laboratories, and the work of the Research Associations. Afterwards he dealt with a number of instances—selected out of a mass of similar examples—of the practical results of research, including radio-telegraphy, which he outlined from the foundation laid by Clerk Maxwell to its present position, the determination of the permissible current-loading of cables, the investigation of alloys, the flow of liquids, the structure of metals, aeronautical problems, and the turbine. He concluded with the remark: "Modern civilisation is based on abstract knowledge, and all experience goes to enforce the dictum of my predecessor 30 years ago, that 'the days are past when an engineer can acquit himself respectably by the aid of mother-wit alone, or of those constructive instincts' which in the past led our predecessors to such brilliant results."

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

The *Industrial Australian* states that in March the Lord Mayor of Sydney recommended to the Finance Committee immediate consideration be given to the salaries of the general manager and deputy general manager of the electricity department. The Lord Mayor stated: "Considering the magnitude of the service, and the satisfactory financial position, together with the great responsibility of the general manager and the deputy general manager, I recommend that the salary of the former be increased to £2,500 per annum, and the latter to £1,666 16s. 8d. per annum, such increases to date from January 1st, 1922, as recommended by the Electricity Supply Committee." The matter was to be dealt with at a special meeting, at which consideration was to be given to the salaries received by the chief officers of the City Council.

Mr. H. A. PRYOR, who has been on the staff of Messrs. Siemens and their associated companies for the past 15 years, has been appointed manager of the Manchester branch of Siemens & English Electric Lamp Co., Ltd., which firm acts as selling agent for Messrs. Siemens Brothers & Co., Ltd. Mr. WM. KIRKHAM, the late branch manager, on relinquishing his appointment with the company, was presented by his colleagues with an illuminated testimonial and silver tea and coffee service.

On the evening of May 11th, at Barrow, the staff and employés of the Barrow Corporation Electricity Undertaking, numbering about 100, met under the chairmanship of Mr. J. F. Heslop, mains superintendent, to honour Mr. H. R. BURNETT, the borough electrical engineer, on his completion of 25 years' service with the Corporation. The chairman referred to the development of the Corporation undertaking under the guidance of Mr. Burnett, who, during the whole of his service, had not had a dispute at the works. He had always been keenly interested in industrial matters and industrial development, and he had done much to consolidate the good feeling and good fellowship that existed among the staff and employés. The speaker referred to Mr. Burnett's work in connection with the scheme placed before the Electricity Commissioners for the whole of the neighbouring district, and he believed that in future years this work would bear abundant fruit. Mr. D. Brearley (works superintendent), Mr. G. E. Smith (consumers' engineer), Mr. J. Airey (chief clerk), and others also spoke. Mr. E. W. Armstrong, the mains foreman and the oldest employé, then asked Mr. Burnett to accept a silver salver and a silver coffee jug. Mr. Burnett expressed his appreciation. He remarked that 25 years was a fairly large proportion of a man's working life, and 25 years in a corporation's service perhaps seemed a little longer in some respects, because whilst there was greater security of tenure and greater regularity of employment, there was a liability to criticism without the opportunity of defence.

Stafford Town Council has increased the salary of Mr. W. H. ROBBINS, chief electrical engineer, from £550 to £700 per annum, with the present emoluments—£100 increase—as from April 1st last, and the remaining £50 on April 1st, 1924.

Stoke Newington Borough Council General Purposes Committee recommends that Mr. E. G. MACKENZIE (technical assistant at the electric station) be granted an increase of salary as from April 1st, 1922, of £50 a year, the increase not to be added to his basic salary and to carry no bonus, the apportionment of the said increase between basic salary and bonus to be decided when salaries are next under general review.

At the annual dinner of the National Union of Manufacturers, at the Hotel Cecil, on June 15th, Mr. GEORGE TERRELL, the president, will be presented with his portrait, painted by Solomon J. Solomon, R.A. The portrait has been subscribed for by members and is being exhibited at the Royal Academy this year.

We read in the *Industrial Australian* that Mr. A. SIMPSON, H.M. Trade Commissioner at Sydney, received instructions to proceed to the United Kingdom on a short official visit. He was to leave Sydney on April 7th.

The same contemporary also states that Mr. J. F. SHEA, a member of the council of the Working Men's College, was recently appointed chief electrical engineer of the South Australian railways. Mr. Shea was originally an apprentice at Newport workshops, and gained the Railway Commissioners' scholarship, which entitled him to attend the full-day diploma course in engineering at the Working Men's College. He obtained the diploma of associateship in 1914, and was subsequently appointed engineeer of ways and works in the Victorian Railways.

Messrs. F. C. LAWRENCE, A.M.I.E.E., A.C.W.A., and F. A. R. PATON, B.A. (Cantab), have severed their connection with Metropolitan-Vickers Electrical Co., Ltd., and have entered into partnership as consulting cost accountants, with offices at 11, Victoria Buildings, Manchester. (Telephone: Central 732.)

Obituary.—SIR W. BUTLIN.—The death occurred suddenly at Guernsey, on Sunday, of Sir William Butlin, a well-known ironmaster, author of numerous papers on technical and social subjects, a specialist in the production of castings for tube railways, and a director of Louis Cassier & Co. He was 72 years of age.

H. T. WILKINSON.—We learn with great regret that Mr. H. T. Wilkinson, M.I.E.E., of Messrs. H. T. Wilkinson and Partners, and managing director of the Wardle Engineering Co., Ltd., died suddenly from heart failure near Port Said on his way home from a successful business tour in India. Mr. Wilkinson was at one time hon. secretary of the Engineers' Club, Manchester, and was one of the founders and a member of the General Committee of the Engineers' Club, London.

Wills.—The late Mr. RICHARD AGAR, of Agar, Cross & Co., the well-known River Plate merchants, left £186,448 gross and £182,928 net personalty.

The late Mr. G. H. EVANS, a director of Joseph Evans and Sons (Wolverhampton), Ltd., left £34,951 gross and £22,749 net personalty.

The late Mr. F. S. THOMAS, of the Saxonia Electrical Wire Co., Ltd., Greenwich, left £3,474 gross and £3,220 net personalty.

NEW COMPANIES REGISTERED.

Newport Electrical Co., Ltd. (189,843).—Private company. Registered May 8th. Capital, £2,000 in £1 shares. To take over the business of an electrical and consulting engineer and contractor carried on by H. Winslow at 3, Dock Street, Newport, Mon., as "H. Winslow and Co." The first directors are:—H. W. Winslow, 85, Marlborough Road, Newport, Mon.; R. Bunt, 1, Cardiff Road, Newport, Mon.; J. P. Brown, 2, Duncombe Place, York. Qualification, £50. Remuneration (except managing director) as fixed by the company. Secretary: J. P. Brown. Registered office: 3, Dock Street, Newport, Mon.

Seaton and District Electric Light Co., Ltd. (189,819).—Registered May 7th. Capital, £10,000 in £1 shares. To carry on the business of suppliers of electricity in all its branches. The first directors are:—Brig.-Gen. G. B. Smith, C.B., "The Cottage," Seaton, Devon; C. Gane, 97, North Gate, Regent's Park, N.W.8; A. M. Dovey, "Dalfall," Beer, Devon; Major-Gen. H. B. H. Wright, C.B., C.M.G., "Seaton Down House," Seaton, Devon. Minimum cash subscription, £5,000. Qualification, £50. Registered office: 1, Violet Terrace, Fore Street, Seaton, Devon.

Hambling Clapp & Co., Ltd. (189,835).—Private company. Registered May 8th. Capital, £1,000 in £1 shares. To take over the business of manufacturers and factors of, and agents for wireless sets and apparatus and electrical appliances and accessories carried on by Hambling, Clapp & Co. at 110, Strand, W.C. The subscribers (each with one share) are:—B. Clapp, "Meadmoor," Brighton Road, Purley, wireless engineer; F. A. Mayer, Stileman's Works, Wickford, Essex, wireless engineer. B. Clapp signs as director. Qualification, 1 share. Registered office: 110, Strand, W.C.

Marchand & Chabloz, Ltd. (189,788).—Private company. Registered May 5th. Capital, £100 in £1 shares. To carry on the business of electrical engineers, manufacturers of, and dealers in electrical, magnetic, galvanic, wireless, and other apparatus, watch and clock makers, &c. The life directors are:—G. Marchand, 28, Gledhow Gardens, Kensington, S.W.; F. Chabloz, 141, Hornsey Road, Finsbury Park, N.4. Secretary: A. Corbat. Registered office: 227a, City Road, E.C.1.

Mackerron & Scott, Ltd. (12,680).—Private company. Registered in Edinburgh May 8th. Capital, £3,000 in £1 shares. To carry on the business of electrical, mechanical, consulting, and contracting engineers, manufacturers of, and dealers in electrical, mechanical, and scientific apparatus, machine equipment, &c. The subscribers (each with 1 share) are:—H. I. MacKerron, 496, Dumbarton Road, Glasgow, electrical engineer; R. Scott, 17, Melrose Gardens, Kelvinside, Glasgow, N., electrical engineer. The first directors are not named. Qualification, 100 shares. Secretary: W. K. C. Murdoch. Registered office: 98, West George Street, Glasgow.

Saunders Patents, Ltd. (189,881).—Private company. Registered May 9th. Capital, £1,000 in £1 shares. To acquire from W. T. Saunders the benefit of a certain invention for improvements in wireless telephony. The permanent directors are:—W. T. Saunders, 23, Victor Road, Teddington, electrical engineer (managing director); F. C. A. Harrington, 17, The Barons, St. Margarets, Twickenham, director; H. Grigg, no address given. Qualification, £50.

Radio Slot Machines, Ltd. (189,845).—Private company. Registered May 8th. Capital, £2,000 in £1 shares (1,200 preference and 800 ordinary). To acquire and turn to account coin-operated time switches for use in connection with radio apparatus, and to adopt an agreement with Tower Carriers, Ltd., G. C. Barclay, H. T. R. Cripps, and R. C. Grasebv. The first directors are:—G. E. Barclay, 13, Earl Street, Westminster, S.W.; R. C. Monro, "Kelvedon," Claygate, Surrey; G. J. Williams, 244, Lancaster Road, Kensington, W.; Amy K. Ferguson, "Reendesert Lodge," Bantry, Ireland (all directors of Tower Carriers, Ltd.); H. T. R. Cripps, "Graydene," Bray, Berks.; R. C. Grasebv, 45, Horseferry Road, S.W.1; J. D. Monro, 21, Brechin Place, S.W.7. Qualification, 1 share. Remuneration as fixed by the company. Registered office: 13, Earl Street, Westminster, S.W.1.

E. Shipton & Co., Ltd. (189,862).—Private company. Registered May 9th. Capital, £1,000 in £1 shares. To adopt an agreement with E. Shipton, trading as E. Shipton & Co. and to carry on the business of telephone, wireless, electrical, mechanical, and general engineers, &c. The first directors are:—E. Shipton, 55, Princess May Road, Stoke Newington, N.16 (permanent); E. J. Baker, 4, Oxford Road, Snakes Lane, Woodford. Qualification, £5. Secretary: H. C. Mundy. Registered office: 14, King Street, Covent Garden, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Scarborough Electric Supply Co., Ltd.—Trust deed dated April 25th, 1923, to secure £80,000 first mortgage debenture stock, constituting a specific charge on the company's land and generating station at Seamer Road, Scarborough, and a floating security on the company's undertaking and property, present and future, including uncalled capital. Trustees: Trust Union, Ltd.

St. Helens Motor and Electrical Engineering Co., Ltd.—Debenture dated April 30th, 1923, to secure £50, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: H. Devany, 75, College Street, St. Helens.

Luminor Signs (British), Ltd.—Particulars filed on May 4th, 1923, of £1,500 debentures, third series, authorised December 5th, 1922, charged on the company's property, present and future, including uncalled capital, the amount of the present issue being £100.

Magnetic Transmission Co., Ltd.—Particulars filed of £10,000 debentures authorised October 18th, 1922, and covered by trust deed dated April 27th, 1923, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £5,050. Trustees: Sir Edward Smith, D.L., J.P., 1, Whitehall Place, S.W., and M. R. Margesson, 2, Great Cumberland Place, W.1.

Cutting Bros., Ltd.—Issue on September 21st, 1920, of £8,000 debentures, part of a series already registered. (Notice filed May 5th, 1923.)

City of Carlisle Electric Tramways Co., Ltd. (62,601).—Return dated February 14th, 1923. Capital, £60,000 in £1 shares. All shares taken up; £60,000 paid. Mortgages and charges, £45,400.

Gent & Co., Ltd. (78,797).—Return dated April 2nd, 1923. Capital, £50,000 in 20,000 preference and 30,000 ordinary shares of £1 each. 4,427 preference and 20,876 ordinary shares taken up. £6,887 paid on 957 preference and 5,930 ordinary shares; £18,416 considered as paid on 3,470 preference and 14,946 ordinary shares. Mortgages and charges, £16,500.

Para Electric Railways and Lighting Co., Ltd. (85,368).—Return dated April 9th, 1923. Capital, £780,000 in 390,000 preference and 390,000 ordinary shares of £1 each. 325,000 preference and 390,000 ordinary shares taken up; £25,040 paid; £689,960 considered as paid. Mortgages and charges, £599,308.

W. T. Henley's Telegraph Works Co., Ltd. (13,795).—Return dated March 16th, 1923. Capital, £1,000,000 in 40,000 preference shares of £5 each and 800,000 ordinary shares of £1 each. 40,000 preference and 650,000 ordinary shares taken up; £5 per share called up on 39,880 preference and £1 per share on 413,080 ordinary shares; £612,480 paid; £237,520 considered as paid on 120 preference and 236,920 ordinary shares. Mortgages and charges, £150,000.

J. H. McBean, Ltd.—H. Appleyard, of Dewsbury, was appointed receiver on April 30th, 1923, under powers contained in charge dated February 17th, 1922.

CITY NOTES.

Lancashire Electric Light and Power Co., Ltd.

In their report for the year ended March, 1923, the directors state that the trading profit of the Parliamentary Co. (the Lancashire Electric Power Co.) for 1922 amounted to £145,632, plus £5,416 brought forward. There has been put to reserve fund £52,000; to income tax reserve, £7,282; and carried forward £5,107; leaving a balance of £86,659 which has been paid to this company in respect of interest and dividend, less income tax. The total amount at the credit of the reserve fund of the power company now amounts to £200,000. The balance of the Lancashire Electric Light & Power Co., Ltd., for the year, after crediting interest and dividend received from the Power Co., and paying the interest on debentures, and other expenses, is £52,483, plus £8,458 brought forward, making £60,941. Out of this a dividend of 6 per cent per annum (income tax free) on the cumulative convertible first preference shares absorbs £28,638; a dividend of 7¼ per cent. per annum (less income tax) on the 7 per cent. cumulative participating preference shares requires £7,734; a dividend of 7¼ per cent. per annum (less income tax) on the ordinary shares requires £8,572; there is put to reserve £10,000, and £5,997 is to be carried forward. In order to meet the capital demands of the power company for further extensions, a resolution of this company was passed in January last increasing the capital to £1,100,000. The directors having received an offer to purchase 225,000 shares, namely, 75,000 of each class of share, upon advantageous terms, have accepted the offer. 75,000 first preference and 75,000 ordinary shares have been allotted and are included in the balance sheet, and the remaining 75,000 7 per cent. preference shares have been allotted since the close of the financial year. In spite of the fact that the textile, engineering, and coal trades upon which the power company mainly depends for its load have been passing through a severe period of depression, there has been a large expansion in output. The efficiency of the generating station has been fully maintained and in a return recently issued by the Electricity Commissioners for the year ended March 31st, 1922, the Power Co. ranks third in Great Britain as regards low coal consumption and high thermal efficiency. The Power Co. has arranged a contract for a further supply to the Rochdale Corporation and a bulk supply is now being given to the Radcliffe Urban District Council. The Power Co. is also extending its mains to Chorley, where a supply will be available in August next. In order to meet these and other demands a contract has been made for a supply of electricity from the Manchester Corporation's power station at Barton, which will shortly come into operation. The results of the Parliamentary Co.'s business have been as follows:—

	1921.	1922.
kWh generated or purchased	62,971,066	90,434,835
Max. load in horse power	38,100	45,850
H.p. connected	54,700	63,000
Receipts	£294,877	£302,181
Expenditure	£200,549	£156,549
Profit on trading	£94,328	£145,632

Meeting held yesterday, Thursday.

Cawnpore Electric Supply Corporation, Ltd.

The report for 1922 shows that the surplus on working is £21,648. After deducting debenture interest, &c., £16,104 is carried to profit and loss account. From January 1st to April 30th, 1923, the estimated revenue from the sale of electricity was £26,000, against £18,650 for the corresponding period of 1922, an increase of £7,350. As the year's expenses included interest on very considerable capital expenditure, the benefits of which are only now appearing in the increased earnings for 1923, £2,348 has been transferred from general reserve to profit and loss, bringing it to £21,731 (including £3,279 brought forward). After paying the preference dividend, and a total of 10 per cent. for the year on the ordinary shares, £667 remains to carry forward (subject to taxation).

Northern General Transport Co., Ltd.

The directors' report for 1922, which was submitted to the meeting on Wednesday, stated that the traffic receipts (less working expenses), dividends, and other revenues amounted to £30,166. After deducting administration expenses, £6,141 for loan and debenture interest, and making a provision of £15,224 for renewals, there remained a balance of £3,031. To this was added £17,569 brought forward, making an available total of £20,600, which it was proposed to allocate as follows: debenture redemption sinking fund, £1,752; dividend of 6 per cent. on the

preference shares (including 3 per cent. already paid), £6,522; dividend of 5 per cent. on the ordinary shares, £11,366; carried forward, £970.

The working results compare unfavourably with those of the previous year. The rolling stock is now in first-class order, having been thoroughly overhauled at great expense. During the year debenture stock to the amount of £2,050 was purchased and cancelled, making a total of £13,550. Investments stand in the books at £403,516.

Potteries Electric Traction Co., Ltd.

The directors' report for 1922 states that the total revenue was £256,197, a decrease of £44,635; and the working expenses £207,547, a decrease of £25,756. After the deduction of all expenses chargeable to revenue, including £11,025 for debenture interest, and a provision of £5,000 for renewals (as compared with £10,000), there remains £10,753, as compared with £27,841 in the previous year. To this is added £6,873 brought forward, making £17,626, which it is proposed to apply as follows: dividend on preference shares at the rate of 5 per cent. per annum, £12,250; £5,376 to be carried forward. The reserve at December 31st, 1922, stood at £113,138, and the renewals fund at £49,081. The report refers to the depressed state of trade in the district and to the increasing competition of motor vehicles. The capital expenditure during the year amounted to £19,931, chiefly in respect of additional omnibuses and land for a new garage. Meeting to-day (Friday).

Vera Cruz Electric Light, Power and Traction, Ltd.

Mr. Vincent W. Yorke (chairman) said at the annual meeting on May 9th that the company's business had been affected by the shipping slump and by political conditions. There had been an improvement in the lighting and power business, but the tramways had suffered severely, and the decrease of £20,000 in the gross profits was wholly attributable to this section of the business. Their interest in the sea-bathing resort near Vera Cruz had also caused a loss, and a small amount of £3,000 was lost by the failure of a local bank. While it would be unwise to speak hopefully of future prospects, there were certain indications which led the speaker to believe that a general improvement in conditions at Vera Cruz might not be far distant. The recognition of the Mexican Government by foreign Powers was imminent and would give greater confidence to those who did business with Mexico.

Johnson and Phillips, Ltd.

In their report for 1922 the directors report that the profit on trading account, &c., after making provision for bad and doubtful debts, and after charging to revenue upwards of £9,000 for maintenance of buildings, plant, &c., amounted to £82,977 plus £15,138 brought forward and £4,779 profit on realisation of investments, making £102,895. Out of this, remuneration of directors, and auditors' and trustees' fees require £1,662; interest on 8 per cent. debenture stock, £28,000; reserve *re* 8 per cent. debenture sinking fund, £15,226; income tax and corporation profits tax (estimated), £5,828; depreciation on machinery and plant, &c., £12,189; leaving available a balance of £39,989. A dividend at the rate of 5 per cent. per annum on the 437,500 ordinary shares, less income tax, requires £21,875, leaving to be carried forward £18,114. Mr. Charles Stewart has been appointed an additional member of the board. The directors express their deep regret at the loss of a valued colleague by the death of Mr. G. E. Davis. Annual meeting held yesterday, Thursday.

Siemens Brothers and Co., Ltd.

The report of the directors for the year ended December 31st, 1922, states that the depression referred to in the last report continued to affect the company's business during 1922, and was accentuated by the engineers' lockout with its resulting disorganisation. Although the value of the orders secured showed an improvement on the previous year, the output from the shops was considerably reduced owing to the diminution of the orders in hand on January 1st, 1922, as compared with those on January 1st, 1921. Every exertion was made to fill the shops, but orders were scarce, especially in submarine telegraph cables and automatic telephone exchanges, and these had only been secured at greatly reduced prices. This, together with the smaller turnover and decrease in value of stocks, was responsible for the diminished profit. Foreseeing dull trade, the directors acted drastically, and establishment charges were reduced wherever possible. The proposals pending for additional submarine telegraph cables to be laid in the Atlantic and Pacific Oceans obliged the directors to recognise the necessity for providing a new cable ship to replace the old S.S. *Faraday* (which was launched in 1874), so as to put the company in a position to share in the anticipated revival in this class of business, and a new ship was ordered in August from Palmer's Shipbuilding and Iron Co., Ltd. She was completed and delivered on April 13th this year, is rather larger and much speedier than the old *Faraday*, and possesses all the improvements in design and equipment which the technical staff have advised necessary for efficiency in carrying out future contracts. The business in lead cables is improving; the shops have been occupied to full capacity; movement is observable in lighting, traction and telephone schemes, in which these cables will be required; and, in order to be ready for the increased demand, it has been decided to incur an expenditure of about £200,000 in the erection of additions to the lead cable shops and their equipment with machinery. In order to effect economy in working and improved results, the company's business in metallic filament incandescent lamps has been amalgamated with that of the English Electric Co., Ltd., under the name of "Siemens and English Electric Lamp Co., Ltd."

Definite assessments are still awaited for the company's liability to Excess Profits Duty for the years 1918, 1919, and 1920. Meanwhile a further sum of £100,000 has been paid in respect of this, making a total payment on account of £200,000. The profit for the year per profit and loss account was £14,041, plus £334,112 brought forward. Deducting the half-year's dividend for six months ended June 30th, 1922, on £300,000 10 per cent. cumulative preference shares, £15,000; payments on account of Excess Profits Duty, £100,000; interest on and redemption of 4½ per cent. debenture stock, £67,439; income tax liability for 1922, £38,405; leaves the balance of profit at £127,310, which it is proposed to carry forward in view of the unsettled liability for Excess Profits Duty. Meeting: Tuesday, May 22nd.

Callender's Cable and Construction Co., Ltd.

The report for the year ended December, 1922, which was submitted at the annual meeting, held yesterday, showed that the balance at credit of profit and loss account was £251,788. Interest on debenture stock absorbs £13,500; 6½ per cent. preference dividend, £26,000; 7½ per cent. preference dividend, £30,000; appropriation for depreciation of buildings, plant and machinery, £30,000; appropriation for depreciation of office furniture, £500. These deductions leave £151,788 plus £150,113 brought forward, making £301,901. The dividend on the ordinary shares, 15 per cent. (less tax) is £75,000, and there is to be carried forward £226,901. The directors consider that the results obtained are satisfactory, especially in view of the serious competition and the general depression which prevailed in most branches of industry during the year. The company was, however, fortunate in obtaining contracts for home and abroad which ensured a fairly steady flow of work to the factory. The improved appliances and plant recently installed there enabled these orders to be dealt with economically, and materially assisted in producing the results shown in the balance sheet. The use of "super-tension" cables is increasing, although the volume of such business anticipated from the general reorganisation of electricity supply under the Commissioners has not yet produced the large orders which were expected. There is, however, every reason to believe that some of these developments, which will result in large quantities of cables being required, will be placed in hand in the near future. The electrification of British railways is also rapidly nearing practical fulfilment. The adverse rates of exchange and other well-known difficulties on the Continent rendered it impossible to carry on business in the countries in which the company had previously done a considerable trade, and these difficulties will continue. On the other hand the business with the Colonies and elsewhere overseas was considerable. Business in rubber wires, in which the Anchor Co. specialises, was much restricted during the year largely due to the decrease of building operations. There are already indications of an improvement, and every effort is being made to enlarge this trade at home and abroad.

Great Northern Telegraph Co., Ltd., of Denmark.

The report of the directors for the year 1922 says that, thanks to measures taken by the Russian Government in the clearing of minefields, it has been possible to repair the Petrograd-Libau cable after an interruption of eight years' duration; the restoration of the company's cables broken during the war is now complete. The cable-laying steamer *Edouard Suenson* was put into commission in October. She supplants the *H.C. Oersted*, and was built in the naval dockyards at Copenhagen; the two steamers were working for about 220 days during the year, and the *Store Nordiske* and the *Pacific* were in commission for 261 days and 160 days respectively. The old *Store Nordiske* has now been replaced by another steamer bearing the same name.

During the year the company fully resumed its former activities in Russia, both with regard to the carrying of Russian terminal traffic and traffic across Russia between Europe and the Far East. The company's office in Petrograd was re-opened in January, 1922, and in March of that year it became possible to recommence the through service to the Far East, *via* Irkutsk, Blagowestchensk, Harbin, and Peking by means of a wire placed at the company's exclusive disposal by the Russian and Chinese Governments. After the restoration of the Kiachta line in September as a result of protracted negotiations between the Chinese and Mongolian Governments the company was in possession of two reliable routes between Irkutsk and Peking, and a considerable improvement in working was effected by the establishment of a repeater station at Omsk. In November last a new office was opened at Moscow. This is connected by a direct wire with the Petrograd office, establishing a quick and reliable service between the Russian capital and Western Europe, America, &c. Another wire between Moscow and Irkutsk, provided by the Russian Administration, affords another route between Petrograd and Irkutsk. During the present year communica-

tion has been established between Irkutsk and Vladivostock, and thus in the comparatively short time of one year the Russian Government and the company have fully carried out the programme outlined in the concession. The lines are maintained by the Russian Government, and its relations with the company have been most satisfactory in all respects. The traffic exchange is as yet small when judged by pre-war standards, being affected in some degree by the Anglo-Russian Government cable, but a decided increase is noticeable, and with the improved conditions now obtaining in Russia it is hoped that the traffic will develop and become once more a source of revenue to the company. Negotiations with the United Kingdom and Sweden have continued but not concluded, and negotiations with China for a prolongation of the agreements between the Government on one hand and this company and the Eastern Extension, &c., Co., on the other, have been postponed for the time being, owing to the political situation. During the year radio telegraphy has deprived the cable companies of a certain amount of revenue. This is attributed chiefly to the diversion of Government business to State-owned radio stations.

The threatened failure of the Danish Landmands Bank concerned the company, although it had no direct relations with the bank. Accordingly the company could not refuse to participate in the reconstruction of the bank by contributing 5,000,000 kr. (about £278,000) for which preference shares have been received. The negotiable value of these shares is not ascertainable and so no value has been shown against them in the list of investments of the reserve fund.

The financial results of the year show a considerable decrease. The traffic receipts are down by £194,000 as a result of the continued decrease in traffic; there is a net decrease of £188,000 in revenue. Excluding rates and taxes, the expenditure fell by £61,200. Owing to the fall in the assessable income of the company—about half a million sterling—the taxes paid by the company amounted to only £53,600 or £257,800 less than in 1921; the income tax in Denmark and other countries has also been reduced. The taxes are not to be treated as ordinary working expenses, but will be defrayed out of the reserve for taxes, leaving a balance of £168,600 to be carried forward.

Notwithstanding the decrease in revenue the board proposes to pay a dividend and bonus of 23 per cent., to allot to the reserve and renewal fund the minimum amount according to the scale fixed by the Articles of Association, *viz.*, £33,333, and to carry forward a balance of £309,760, or practically the same amount as was brought forward from the previous year.

Upon the assets side of the balance sheet credits at banks and cash in hand are shown at £1,278,000, as against £1,950,000 in the previous year. This decrease is accounted for by the purchase of bonds for the reserve and renewal fund, and also by payments made in connection with the new cable steamers.

The remainder of the dividend and bonus (7½ per cent. and 9½ per cent., 5 per cent. having been paid) will be payable at the offices of the company's bankers on and after June 1st. The meeting is to be held at Copenhagen on May 31st.

Swiss Companies.

The *Société Franco-Suisse pour l'Industrie Electrique*, of Geneva, which has a share capital of 25,000,000 fr., is unable to make any distribution for 1922, as was also the case in the two preceding years; nevertheless, it was possible last year to reduce the deficit of 872,000 fr. for 1921 to 111,000 fr.

The *Motor Applied Electricity Co.*, of Baden, Switzerland, after writing down securities, concessions, and doubtful debts, by 1,626,000 fr. in 1922, as against 776,000 fr. in the previous year, proposes to carry forward the balance of 61,000 fr., as compared with 42,000 fr. carried forward in 1921.

French Companies.

The *Société Française des Electrodes*, of Lyons, reports gross profits amounting to 860,000 fr. for 1922, as compared with 404,000 fr. in the preceding year. After having written off 545,000 fr., the balance permits of the distribution of a rate of 30 fr. per share, as against 25 fr. in 1921.

The *Société Française Radio-Electrique*, after having made provision for depreciation, records net profits of 3,455,000 fr. for 1922, as compared with 1,199,000 fr. in the preceding year. It is proposed to pay a dividend at the rate of 25 fr. per share on share capital of 12,000,000 fr., as against the same rate on 7,000,000 fr. in 1921.

The *Compagnie Radio-France*, reporting on its first financial period comprising the 18 months ended with last December, states that the installations had been carried out according to the programme fixed at the constituent meeting in June, 1921. They comprised the transmitting station at Sainte-Assize, the Villecresnes receiving station, and the central office in Paris, where all operations are concentrated. The convention with the French State of October 29th, 1920, had recently been finally completed by the agreement of December, 1922, which settled the relations between the company and the French Telegraph Administration. The accounts showed an insignificant deficit of 5,482 fr., which was all the more satisfactory as the financial year was one of construction and organisation, and only comprised five months during which receipts were earned. At the recent meeting the Chairman (M. Jules Cambon) made much of the fact that France was now no longer dependent upon foreign cables for telegraphic communication.

The ordinary meeting of the *Electrification Industrielle* approved the accounts for the working year 1922, showing a profit balance of 412,000 fr.; deducting the loss of the foregoing year, a net profit of 238,568 fr. resulted. The dividend was fixed at 10 per cent. per share.

Energie Electrique du Sud-Ouest.—The accounts of this company for the year 1922 showed net profits of 3,883,326 fr., which with the carry-over from 1921 made a total of 3,919,700 fr. The dividend was fixed at 40 fr. gross per priority share and 32.50 fr. per ordinary share. Weather circumstances having become more normal, the hydraulic stations of Tuilière and Mauzac had been able to work throughout the year; the use of the steam generating stations had consequently been restricted, and their output had been much less than in 1921. The drop in the price of coal had likewise helped to lessen the steam charges. The supply of current to customers had advanced considerably during the year. The length of the 50,000-volt network now totalled 407 km.; that of 13,000-volt lines, 797 km.; and those of low-pressure secondary distribution networks, 354 km. To meet future demands and guard against eventualities, a third 10,000-kW turbo-alternator had been ordered for the du Floriac station, which was expected to be placed in use this summer.

German Companies.

The *Hanover Electric Motor Co.* has declared a dividend at the rate of 30 per cent for 1922.

The *Electrical Undertakings Co.*, of Berlin, has increased the rate of dividend from 20 per cent. in 1921 to 100 per cent. last year.

The *Lloyd Dynamo Co.*, of Bremen, earned net profits of 13,207,000 marks in 1922, comparing with 752,000 marks in 1921. The rate of dividend was increased from 10 per cent. in 1921 to 50 per cent. last year.

The *German Cable Works Co.*, of Berlin-Lichtenberg, records net profits of 143 millions of marks for 1922, and a dividend at the rate of 100 per cent. on share capital of 80 millions. In 1921 the net profits were 6.19 millions and the dividend 20 per cent. on a capital of 20 millions of marks.

The directors of the *Voigt & Haeffner Co.*, of Frankfort-on-Main, recommend a dividend at the rate of 150 per cent. for 1922, as compared with 20 per cent. in the previous year. It is proposed to increase the ordinary share capital, which now amounts to 80,000,000 marks, by the issue of further shares for 110,000,000 marks.

The *High Frequency Machine Co.*, of Berlin, proposes to pay a dividend at the rate of 75 per cent. out of net profits of 8,000,000 marks in 1922, as compared with 30 per cent. and 1,500,000 marks respectively in the previous year. The report states that the Tuckerton radio station has been handed over to the Compagnie Universelle de Télégraphie et de Téléphonie Sans Fil or its nominees.

The *Saxony Works, Light & Power Co.*, of Niedersedlitz, reports gross profits of 275.70 millions of marks for 1922, as compared with 40.11 millions in the previous year. After having defrayed the usual charges and made provision for depreciation, the net profits permit of the payment of a dividend at the rate of 50 per cent., this contrasting with 20 per cent. in 1921. As a result of the general situation, the report states that the stock of orders and degree of activity of the works have decreased in the new financial year.

The *Wireless Oversea Communication Co.*, of Berlin, reports that the traffic both from the Nauen and the Filvese stations further favourably developed in 1922, particularly with the United States. The antenna installation at Nauen was being reconstructed, the transmitting capacity was being increased, and the number of lines simultaneously in operation was being augmented. After having made provision for depreciation and renewals, the accounts exhibit net profits of 21.8 millions of marks, as against 3.4 millions in 1921, and the dividend is at the rate of 50 per cent.

Italian Companies.

The *Società Generale Italiana di Elettricità* (Milan).—The report detailed the progress of the new works in hand. In the course of the year, besides increasing the power of the steam station, advance had been made with the operations at the Ovesca fall. Construction had been pushed forward, or partly completed with other plants for the account of companies in which the Edison Co. is particularly interested. The balance for 1922 closed with a profit of 17,288,837 lire, from which dividends of 32 lire and 16 lire respectively on each of the old and new shares were declared. The capital of the company is 180,000,000 lire.

Società Lombarda Distribuzione di Energia Electrica (Milan) (capital 52,000,000 lire).—According to the report, in the past year the small station at Turbigo Inferiore, the first example in Italy of a station controlled from a distance had been started. A connection had also been made between the Pontetresa-Varano 40,000-volt line and the Canton of Ticino, while progress had occurred with the works in hand on the Upper Brembo river. The profit available for dividend from the year's working was 5,841,861 lire, from which was distributed 57.50 lire to the old shares and 17.25 lire per share of the second group.

The *Elettricità Alta Italia* (Turin) distributed 20 lire per share dividend on its capital of 48,000,000 lire from net profits earned of 4,345,000 lire in the past year. A dividend of 10 lire per share was paid on the result of the past year's working of

the *Società Idro-elettrica Piemonte* (Turin). Reversing its loss on the working of the foregoing working year by earning a profit of 1,341,606 lire in 1922, the *Società Elettrica ed Elettrochimica del Caffaro* (Milan) distributed a dividend of 25 lire per 250-lire share. Recording an available balance of 1,828,853 lire on the year, the *Società Anonima Gheaccio, de Forza e Luce* (of Lodi) declared a dividend of 20 lire per share. A dividend of 5 per cent. on its capital of 10,500,000 lire was sanctioned by the board of the *Società Elettrica Interprovinciale* (of Verona), as the outcome of net profits of 570,000 lire. The *Industria Elettrica Scledense* (of Schio) distributed a dividend of 6 per cent. for the past year.

Società Adriatico di Elettricità.—The report presented at the recent meeting detailed the progress of the arrangements for new plants. The Casteletto station had started with a constant power of 6,000 kW; in June two groups of 16,000 kW would be under way at the Fadalto station, and by the beginning of next year the Nove station would receive its complement with another group of 16,000 kW. The available balance was 11,087,468 lire, from which a dividend of 10 lire per share was sanctioned.

Ever-Ready Co. (Great Britain), Ltd.—The report for the year ended March, 1923, states that the amount available for appropriation after writing off depreciation, the balance of the preliminary expenses, and reserving for bad and doubtful debts, is £53,837. The interim dividends absorbed £13,427. A final dividend of 6¼ per cent. on the preference shares, making the maximum of 10 per cent. for the year, requires £8,752; and a final 6¼ per cent. on the ordinary shares, making 10 per cent. for the year, requires £16,185, leaving to be carried forward £15,472. During the year the company purchased for cash the whole of the share capital of a competing concern, and a half interest in a company carrying on an allied business. These two undertakings have made satisfactory initial progress.

Anchor Cable Co., Ltd.—According to the financial papers there was a profit for the year ended December 31st, 1922, of £7,081. Debenture interest absorbed £2,250, leaving £4,831 plus £104,132 brought forward, making £108,963. The directors recommend a dividend of 20 per cent., whereof 10 per cent., less tax, was paid in November, 1922, carrying forward £95,963.

Submarine Cables Trust.—The revenue for the year ended April, 1923, was £36,013, and the expenses £1,831, leaving £34,182, plus £50 brought forward. After providing £6,948 to meet payment of coupons, £27,229 has been transferred to redemption fund, leaving £55 to carry forward.

Rangoon Electric Tramway & Supply Co., Ltd.—The directors' recommend a dividend of Rs.1 per share, free of tax, to shareholders domiciled in India or Burma, on ordinary shares, making Rs. 1¼ for the year; £32,500 to reserve for renewals; £1,322 for depreciation on sundry assets; £5,165 for Indian income tax; £4,000 for corporation tax; £3,765 for employés' provident fund and bonus; £22,589 for repairs, renewals, &c.; £3,061 for stamp duty on increased capital; £10,000 to dividend equalisation fund; £18,228 carried forward.

Prospectus.—*The South Wales Power Co., Ltd.*—The subscription list was closed within a few hours of the publication of the prospectus offering an issue of £600,000 six per cent. first mortgage debenture stock at 98 per cent. All moneys received by the Parliamentary Co. out of the proceeds of the present issue will be used to complete the extension of the generating station of the Parliamentary Co., and the installation of two new 20,000-h.p. turbo-alternators, with the necessary boilers and ancillary plant, and to extend the distribution system. The first of the above machines has already been delivered and is in course of erection, and is expected to commence working by the end of June, 1923.

Hurst Nelson & Co., Ltd.—Interim dividend of 1s. per ordinary share, free of tax.

STOCKS AND SHARES.

Tuesday Evening.

The course of Stock Exchange markets has not been running very smoothly. Prices have had such a long and protracted rise that it stood to reason there must be a halt called sooner or later. The immediate reason for the pause imposed upon previous buoyancy is, nominally, the fresh developments and chaos in foreign politics, added to a hint that the banks at home contemplate placing something of a check upon the speculation in commercial and industrial shares which has been going on for some time past. Probably the real reason is that people cannot continue to buy stock indefinitely, and it may be that the faint, though steady, revival in trade conditions is responsible for the lull in the stream of capital directed to Stock Exchange markets. No doubt all these explanations play their part in bringing about a present hiatus that has the effect of reducing to some extent the strength of prices and of leading to a more cautious outlook on the part of the investor.

So far as the electrical markets are concerned, the tendency which is so very apparent in most sections of the Stock Exchange has had little effect, for prices are well maintained in most groups. There has been, however, a setback in Home Railway stocks, and in this decline the Undergrounds sympathised. Metropolitans, after touching 73, gave way to 71. Districts fell from 56¼ to 54¼. Undergrounds at 97¼ are a little below the company's best, and the company's £10 shares drooped to 3. At the same time, the reaction in War Stock and in some of the other gilt-edged issues caused a slight weakening amongst the prior-charge securities of the electrical and other railway companies, though these are held so firmly that the movement is little more than sympathetic, and any effort to buy lines of stock is met with the usual statement that there is no substantial quantity to be obtained.

Electricity supply shares hold all their previous strength. County of London Electric new ordinary, in which there has been a fair amount of speculation, have given way a shade to 14s. 9d. premium, comparing with 16s. 3d. as the top price recently attained. The old shares are a little easier at 38s. 9d. Holders will be well advised, however, to pay no heed to such minor fluctuations. Indeed, if the decline goes further, to the extent, say, of a shilling or so, it may be well to add to the holdings that in most cases were acquired at prices materially lower than the present levels.

In the other cases, where £10 and £5 shares are being divided into the more popular denomination of £1, the effect is seen in the greater elasticity imparted to the market for the shares. No increase in speculation has occurred, and proprietors of the shares have the advantage of seeing their securities much more readily negotiable than they were in the past. Bournemouth and Poole ordinary have risen to 31s. 3d. middle, equivalent to 15¾ for the old £10 shares. The prospectus appeared on Monday night of £600,000 South Wales Electrical 6 per cent. debenture stock offered at 98, and the subscription-lists closed within two or three hours. Several new issues are known to be in course of preparation, and before the present month is out it is likely that there will be an interesting offer of stock from one of the electricity companies which operates outside the City.

Charing Cross shares have risen 7s. 6d. Chelsea at 35s. are in their £1 guise equal to 8¾, and so are 5s. up. Bromley (Kent) advanced to 25s. 6d.

Midland Counties Electric 6 per cent. preference are still offered at 3d. premium, and might possibly be obtainable at their par price of 5s. paid, at which the return would be, of course, 6 per cent. on the money. North Metropolitan Electric 6 per cent. preference shares at 22s. 3d. give £5 8s. per cent. Scottish Power 8 per cent. preference can be bought at 25s. 3d., affording six guineas per cent. yield. There is a small parcel of British Electric Transformer 7 per cent. preference on offer at 19s. 6d., the return being £7 3s. 6d. per cent. on the money, with dividends in March and September. It is scarcely necessary to add the usual truism that in considering questions of yield, the lower the return the less, in most cases, is the element of speculation.

Telegraphs and Telephones are steady, with rises in the two Anglo-American stocks and Globe Telegraph shares. On the other hand, Great Northerns went back to 30¼, and Indo-Europeans at 32¼ are 3 points down. Marconis, after a somewhat dull tendency, firmed up again to 2 5/16, their previous price, and Canadians, which fell to 9s., rallied to 9s. 3d. Business was done a day or two ago in Constantinople Telephone ordinary shares at 25s.

Brush Electrical ordinary are unchanged at 27s., but the company's debenture stocks are better, the 5 per cent. prior-lien rising to 91 and the 4½ per cent. first debenture to 80. Something of a feature is the strength of Mexican Light and Power issues, the common and preferred having gained 5 points, and the first bonds at 76½ being 1 higher, after their sharp rally of last week. Mexico Tramways fives put on 2 at 84½. The London group is unchanged. Anglo-Argentine 5 per cent. debenture at 81½ is a point down, and the company's preference shares also are dull.

Siemens weakened further to 16s. 3d., and the 4½ per cent. debenture stock fell to 84½, on the issue of the report, which is certainly a depressing document. The interest on the debenture stock has barely been earned. The board speaks hopefully of the company's prospects, but the results disclosed have had a chastening effect upon the prices of shares in similar companies. General Electrics are 1s. 3d. lower at 19s. 6d. English Electrics fell to 17s. 3d. Metropolitan-Vickers preference at 2¼ are 1/16 down.

The manufacturing group as a whole is on the dull side, with falls in British Aluminium, British Insulated, and Henleys. Babcock & Wilcox shed 2s. 6d. to 4½, owing to selling by a somewhat stale bull account which has been built up since the dividend and splitting announcements. When the present sellers are finished, the price is likely to go better. Rubber shares gave way, in consequence of a further dwindling in the price of the raw stuff, and amongst armament, iron and steel and coal issues, the tendency, after being heavy, took a turn for the better on Tuesday evening.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Nom.	Dividend. 1921.	Dividend. 1922.	Price May 15. 1923.	Rise or fall.	Yield p.c.
	£					
Brompton Ordinary	1	12	12	36/6	—	£6 11 4
Charing Cross Ordinary ...	5	9	14	11½	+ ⅜	6 5 10
do. do. do. 4½ Pref.	5	4½	4½	4½	—	5 6 0
Chelsea	1	6	10	12⅜	+ ¼	5 14 3
City of London	1	14	15	2½	+ 5/16	6 8 2
do. do. 6 % Pref. ...	1	6	6	23/-	—	5 4 4
County of London	1	8	10	38/9	−9d.	5 3 3
do. do. 6 % Pref. ...	1	6	6	23/-	+6d.	5 4 4
Edmundson's Ordinary	3	Nil	—	2½	—	Nil
do. 6 % Pref. ...	5	12/-	—	4½	— ½	6 13 4
Kensington Ordinary	5	10	12	8⅔	—	6 13 4
London Electric	3	4	10	4⅔	—	6 8
do. do. 6 % Pref. ...	5	6	6	5½	—	5 17 1
Metropolitan	1	7	8½	29/-	+6d.	5 17 4
do. 4½ % Pref.	1	4½	4½	17/-	—	5 6 0
Newcastle-on-Tyne Ordinary ...	1	Nil	2½	7/8	—	2 17 2
do. 5 % Pref. ...	1	5	5	15/9	—	6 7 0
do. 7 % Pref. ...	1	7	7	24/6	—	5 14 2
Notting Hill, 6 per cent. Pref....	10	6	6	9½	—	6 9 9
North Met. Elec., 6 % Pref. ...	1	6	6	1 1/16	—	5 13 0
Urban Ordinary	3	Nil	—	1⅝	—	Nil
do. 5 % Pref. ...	5	2½	—	4⅔	—	5 5 3
St. James' and Pall Mall ...	5	12	14½	11	—	6 11 10
South London	1	7	10	1⅔	—	5 14 3
South Metropolitan Pref. ...	1	7	7	1 3/16	—	5 14 10
Westminster Ordinary	5	10	12	9⅔	—	6 4 4
Whitehall Elec. Invst., 7½ % Pf.	1	7½	7½	19/6	—	7 13 10

Home Rails.

Central London Ord. Assented	Stock	4	4	73	—	5 9 7
Metropolitan	,,	2½	3½	71½	−1	4 18 7
do. District	,,	1	3	54½	−1½	5 10 2
Underground Electric Ordinary	10	Nil	Nil	3	— ¼	Nil
do. do. "A" ...	1	Nil	Nil	8/6	−6d.	Nil
do. do. Income	Stock	4	5	97½	—	*5 2 9

Telegraphs and Telephones.

		Dividend. 1920.	Dividend. 1921.			
Anglo-Am. Tel. Pref.	Stock	5	6	104½	+ ½	5 14 10
do. Def.	,,	1½	34/6	22⅝	+ ¼	6 11 2
Chile Telephone	5	6	6	6½	—	4 16 0
Cuba Sub. Ord.	10	7	7	7½	—	9 6 8
Eastern Extension	10	10	10	18⅔	—	5 6 8
Eastern Tel. Ord....	Stock	10	10	187½	—	5 6 8
Globe Tel. and T. Ord.	10	10	10	19	+ ¼	5 5 3
do. do. Pref.... ...	10	6	6	11⅜	+ ¼	5 3 0
Great Northern Tel.	10	21	22	80½	— ½	7 5 6
Indo-European	25	10	10	32½	−3	5 7 8
Marconi	1	25	15	2 5/8	—	6 10 0
Oriental Telephone Ord. ...	1	12	12	2⅝	—	*4 3 6
United R. Plate Tel.	5	8	8	7½	—	*5 10 4
West India and Panama ...	10	Nil	Nil	5/-	—	Nil
Western Telegraph	10	10	10	18⅔	—	*5 6 8

Home and Foreign Trams, &c.

Anglo-Arg. Trams. First Pref.	5	5½	12½	8½	— ⅛	8 9 0
do. do. 2nd Pref.	5	Nil	5½	2 1/16	— ¼	9 7 2
do. do. 5 % Deb.	Stock	5	5	81½	−1	6 2 8
British Electric Traction Ord.	,,	4½	—	74½	—	6 0 10
do. do. 6 % Pref.	,,	6	6	100	—	6 0 0
Brazil Tractions...	100	Nil	Nil	51	−1	7 16 10
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	87½	—	5 15 7
do. do. Preferred	,,	5	93/-	78½	—	*6 0 0
do. do. Deferred	,,	8	124/-	88½	—	*6 19 9
do. do. Deb. ...	,,	4½	4½	81	+1	5 5 0
Lond. & Sub. Trac. 5 % Pref.	1	2½	3½	11/-	—	9 2 0
London United Tram. Deb. ...	Stock	4	4	65½	—	6 2 2
Mexico Tram. 5 % Bonds ...	—	Nil	Nil	84½	+2	5 18 4
do. 6 % Bonds ...	—	Nil	Nil	67½	—	Nil
Mexican Light Common ...	100	Nil	Nil	26½	+5	Nil
do. Pref.	100	Nil	Nil	56½	+5	Nil
do. 1st Bonds ...	—	Nil	5	76½	+1	6 10 9

Manufacturing Companies.

Babcock & Wilcox	1	15	20	4½	— ¼	4 14 1
British Aluminium Ord. ...	1	10	5	20/9	−1/-	4 16 5
British Insulated Ord.	1	15	15	2 7/8	— ⅛	6 3 0
Callenders...	1	15	15	2 7/8	—	6 3 0
do. 6% Pref.	1	6½	6½	23/-	—	5 13 1
Crompton Ord.	1	10	5	2½	—	6 13 4
Edison-Swan	1	10	Nil	4/3	—	Nil
do. do. 5 % Deb.	Stock	5	5	64	—	7 16 4
Electric Construction	1	10	10	28/9	—	6 19 2
English Electric	1	8	5	17/3	−9d.	5 16 0
do. do. Pref.	1	6	6	20/6	—	5 17 1
Gen. Elec. Pref.	1	6½	6½	23/3	—	5 11 10
do. Ord.	1	10	5	19/6	— 1/8	5 2 7
Henley	1	15	15	2 1/8	— ⅛	6 3 0
do. 4½ Pref.	5	4½	4½	4½	—	5 0 0
India-Rubber	1	10	—	14/6	—	—
Met.-Vickers Pref.	2	8	8	2½	— 1/8	6 8 0
Siemens Ord.	1	10	10	16/3	−9d.	Nil
Telegraph Con.	12	20	20	25½	—	*4 16 0

* Dividends paid free of Income Tax.

MARKET QUOTATIONS FOR CHEMICALS AND METALS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

CHEMICALS, &c.	Price May 16th.	Fortnight's Inc. or dec.
a Acid, Oxalic ... ... per lb.	6¾d.	...
a Ammoniac, Sal ... ... per ton	£60	...
a Ammonia, Muriate (large crystal) ,,	£51	...
a Bisulphide of Carbon ... ... ,,	...	...
a Borax ... ... ,,	£28	...
a Copper Sulphate ... ... ,,	£26 15s.	...
a Potash, Chlorate ... ... per lb.	4d. to 4½d.	...
a ,, Perchlorate ... ... ,,	5d.	...
a Shellac ... ... per cwt.	£18 10s.	10s. dec.
a Sulphur, Sublimed Flowers ... ,,	£9	...
a ,, Roll ... ... ,,	£8 10s.	...
a Soda, Chlorate ... ... per lb.	3d.	...
a ,, Crystals ... ... per ton	£5 10s.	...
a Sodium Bichromate, casks ... per lb.	4½d.	...
METALS, &c.		
b Aluminium, Ingots ... ... per ton	£110 to £115	...
b ,, Wire .. .. per lb.	1/9 to 2/6	...
b ,, Sheet ... ... ,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—		
Grade I ... ... per ton net	£182	£18 dec.
Grade II ... ... ,, ,,	£130	£11 dec.
Grade III... ... ... ,, ,,	£73	£4 dec.
c Brass (rolled metal 2" to 12" basis) per lb.	10¼d.	¼d. dec.
c ,, Tubes (solid drawn) ... ,,	1/0½ to 1/0⅔	¼d. dec.
c ,, Wire, basis ... ... ,,	10¼d.	¼d. dec.
c Copper Tubes (solid drawn) ... ,,	1/2½d.	¼d. dec.
c ,, Bars (best selected) ... per ton	£104	£2 dec.
c ,, Sheet ... ... ,,	£104	£2 dec.
c ,, Rod ... ... ,,	£104	£2 dec.
d ,, (Electrolytic) Bars ... ,,	£77	55/- dec.
d ,, ,, Sheets ... ,,	£145 10s.	...
d ,, ,, Wire Rods ... ,,	£87	55/- dec.
d ,, ,, H.C. Wire per lb.	10¾d.	⅛d. dec.
f Ebonite Rod ... ... ,,	3/6	...
f ,, Sheet ... ... ,,	3/-	...
n German Silver Wire ... ... ,,	2/3	...
h Gutta-percha, fine ... ... ,,	5/6	...
h India-rubber, Para fine ... ... ,,	1/2	¾d. dec.
i Iron Pig (Cleveland Warrants) ... per ton	92s. 6d.	...
i ,, Wire, galv. No. 8, P.O. qual. ,,	£25	...
g Lead, English Pig ... ... ,,	£26 5s.	15/- dec.
g Mercury ... ... per bot.	£10 to £10 2s. 6d.	...
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An Electromagnetic Inductor.—At a recent meeting of the Physical Society of London, an electromagnetic inductor was demonstrated by Mr. L. F. Richardson, F.Inst.P. The apparatus is intended for teaching purposes, and serves to introduce students at an earlier stage than usual to a quantitative conception of electromagnetic e.m.f. Like the Lorentz apparatus, the present instrument involves a rotating conductor and produces a steady electromotive force. Two bicycle wheels are mounted vertically and co-axially and driven in opposite directions by a 4-volt motor, the driving band being an endless wire which passes from the motor-pulley over one wheel, under an idle pulley, and back over the other wheel to the motor-pulley. The electromotive forces generated by the revolution of the wheels in the earth's field are thus added (the rims of the wheels being electrically connected through the driving wire), and their sum can be tapped from terminals connected to the hubs of the wheels. From the speed of the wheels and the length of a spoke, the e.m.f. can be found in terms of H. It can be compared with that of a Daniell's cell by arranging the latter as the source of current in a potentiometer. The cell is connected in series with a fixed resistance of 100,000 ohms, and with a variable resistance of ohms and tenths, the inductor in series with a galvanometer being shunted across the variable resistance. Results accurate to 4 per cent. can be obtained with care. Errors due to thermal e.m.f. are eliminated by turning the apparatus through 180 degrees and repeating the observations.

Electric Signs in New York.—There are 9,577 electric signs in New York, according to a census made recently by the New York Edison Co. The signs advertise every kind of business, and over one million lamps are required to light them, 947,623 of which are 10-watt lamps.

ELECTROMAGNETIC FORCES.*

A Proposed Revision of the Laws.

By CARL HERING, Fellow A.I.E.E.

(*Concluded from page 755.*)

One of the deductions from this law is of special interest because it has been most hotly contested. There is, however, also another proof of this deduction which is entirely independent of this law (and therefore aids in confirming the law). If a current-carrying conductor be lengthened (as for instance by stretching, sliding contacts, mercury troughs, &c.) new flux will be produced around the added part and the production of this will generate a counter e.m.f., as in any conductor in which a current is started. Hence it would follow from this law that the circuit itself could produce such a lengthening if the necessary freedom of motion existed. In other words, a current tends to stretch or lengthen its conductor, or more generally, there are longitudinal forces tending to move the conductor in the direction of its axis.

This force, the existence of which can readily be shown experimentally, the writer years ago colloquially termed the "stretch effect," it being a complementary phenomenon to the "pinch effect" which tends to crush the conductor radially; both seem to follow the same laws and lead to the same ultimate result in liquid conductors by rupturing them, when strong enough.

This longitudinal force is also a consequence of conceiving that these electromagnetic forces have their real origin and abutments in the material of the conductor at the seat of the moving electron which causes them; that is, the forces in the field around a conductor are actions at a distance (as Faraday maintained). Physicists have emphatically denied, and many of them do so still, that such a longitudinal force exists or could exist.

The longitudinal force does not appear in the usual mathematical treatments of electromagnetic forces; the reason seems to be that such treatments were originally based on a special case in which this longitudinal component consists of two opposite forces which are exactly equal and therefore drop out of the mathematics; having once dropped out, this force can, of course, never again reappear in any subsequent mathematical deductions which are based on this original case even when they are unequal.

These two new forces, the pinch effect and the stretch effect, are generally not great enough to crush or stretch solid conductors (though they might perhaps act on the softened filaments of forced incandescent lamps), but with liquid or gaseous conductors like those in some electric furnaces or in the arc, they may become of vital importance, being sometimes quite formidable, and should therefore be recognised, studied, and included in mathematical treatments; to deny their existence might check possible progress and developments. That they are of practical importance is shown by the fact that hundreds of electrical furnaces are at present in daily successful use in which this longitudinal movement of the liquid conductor by its own current is the absolutely essential factor.

Unlike the stretching of a compressed helical spring, this stretching theoretically continues indefinitely and is constant if the current and the cross-section of the conductor remain constant, as in a mercury trough. As in all these phenomena, it will no doubt be found to increase as the square of the current. It is independent of the direction of the current or the length of the conductor. For the same current it becomes greater the smaller the cross-section and can rupture the circuit by tearing it. It no doubt is greatest at the centre of a round conductor and is least at the circumference. In a liquid conductor the motion is therefore greater along the central axis than near the circumference. Like a compressed helical spring a flexible circuit secured only at the two ends may form itself into the shape of the letter *C*, as is often seen in the arc, or even like the letter *S*, if thereby it can lengthen itself. It has been suggested by a noted physicist that this might explain the sinuous character of a bolt of lightning.

A straight conductor leading down into a large liquid conductor tends to be moved upward out of the liquid, if the proper freedom of motion exists, and new flux will appear around the lengthened part, causing the counter e.m.f. In general, where there exists any difference of flux density near a conductor there will be a tendency to produce a motion to equalise this flux density if that motion would generate a counter e.m.f. In experiments care must of course be taken that the force is not counterbalanced by an equal and opposite force somewhere else, which is generally the case. The longitudinal force may be made very evident by making the two opposing forces unequal.

*Abstracted from the *Journal* of the American Institute of Electrical Engineers.

The Corner Effect.

Many years ago the writer noticed that in a wide mercury trough which turned a right-angled corner, there was great agitation of the mercury at that corner when a large current flowed, showing the presence of decided local forces; the current was not great enough to show a marked pinch effect in the straight parts; he called it the "corner effect." The writer's explanation was that as the amount of flux must of course be the same on the inside and outside of the corner, the density must be far greater on the inside part of the corner, therefore the forces on the mercury there must be far greater than those on the outside part, hence the agitation.

Recognising the existence of the longitudinal force, this experiment can also be described as the mutual action of two currents whose conductors are inclined toward each other; the forces will of course be greatest where they are nearest to each other, in this case at the corner. When these two currents are unlike in direction (as in the above case) there should be a longitudinal flow of the conductor away from the corner, and for like currents toward the corner. An electric furnace based on this, for obtaining a unidirectional flow of the liquid conductor, operated as predicted, the motion being quite strong and rapid.

Quantitative Value of the Pinch Effect.

In the c.g.s. system the writer found that the quantitative value of the pinch effect at the central axis of a circular conductor was $p=i^2/s$ in which p is the pressure in dynes per cm², i the current in c.g.s. units, and s the cross-section in cm². This pressure is, of course, greatest at the centre and least at the circumference.

No one has yet deduced the quantitative formula for the longitudinal force, but the writer has reasons to believe that the quantitative formula for the stretching should be exactly the same as that for the pinch effect.

General Law of Induction.

Our laws of induction (Faraday's law of cutting lines of force and Maxwell's law of change of linkages in a complete circuit) were based on special cases. They have been invaluable and perfectly satisfactory when limited to those special cases. But trouble and misfits generally arise when the laws for one special case are applied to another special case; it is unwise to attempt it. Moreover, as both are special cases, can we depend upon it that together they cover all possible cases, without exception, that is, are they universal?

The writer maintains that this state of affairs is not satisfactory and that we ought to look for a more fundamental general law of induction, of which the present ones would be special cases, to which they should then be limited.

It has been claimed that a magnetic field is completely specified by its intensity and direction. This means that if the source, either a magnet or a current-carrying conductor, moves in such a way that the field at any outside point does not alter its intensity or direction, then the field does not move, in the sense that it would not cause induction in a fixed conductor. Experiments seem to indicate that each line is attached to its source, the conductor, as the rim of a wheel is attached to its hub, except that the attachment is elastic If so, the above definition of a field is incomplete and should include a reference to the motion of the source, even if such motion does not alter the intensity or direction at any specific point.

Our usual mathematical treatment has misled us in creating a very positive and nearly universally accepted belief that the only force which can possibly exist is one perpendicular to the conductor, like the one in the definition of the unit of current. This has checked progress. The usual mathematical treatment should not have been based on a special case in which the longitudinal force happens to fall out in the mathematics. A new mathematical treatment should now be devised in which the longitudinal force is recognised.

It is believed that such a system could be based on the assumption of only a single magnetic force, the tension along a line of force; then deduce the other, the repulsion of like lines, on the basis that there is an action analogous to that in hydrodynamics, and that therefore this one force can produce motions in *any* other direction depending only on the freedom of motion which exists. It should also be based on the forces being actions at a distance, the abutments of these forces being in the material of the conductors and in that part in which the corresponding electron is moving.

Starting with the tension along a straight line of force (the pull between magnets) as the most basic fundamental, deduce from it the repulsion of like lines and the radial force on the

conductor, from the principles of hydrodynamics; then the two forces in a single conductor, the pinch effect and the stretch effect, which are independent of the length; then those between unit lengths of conductors, and those between magnets and unit lengths of conductors. Omitting the ether, recognise that the forces in a field are an action at a distance, having their abutments in the material of the conductors or magnets, and that therefore the imaginary lines of force must be pictured as having some physical elastic connection with their source, the moving electron. Formulate in electrical terms a general law of motion (like the one suggested above) based on the long-established general law in mechanics concerning the self-conversion of potential into kinetic energy. Finally on this law, combined with the Lenz law, base the general law of generators, that is of induction.

[The paper was accompanied by a detailed account of numerous experiments purporting to prove the author's contentions.]

LATIN-AMERICAN ELECTRICAL NOTES.

(By our Special Correspondent.)

The Municipalities of Chimbo and San Miguel (Republic of Ecuador), have resolved to construct an electric light plant for their joint use, Congress voting the sums necessary for the installation. An electric light plant and a drinking-water system are also to be installed in the cantonal seats of Cotacachi and Montufar, the cost of these being defrayed from special taxes levied upon the sale of liquors and other cantonal revenues.

In the town of Colinas, Santa Barbara, Republic of Honduras, a company known as the Esfuerzo Electríco Comerciál is to work a concession granted by the Government to erect and operate an electric plant at any point in the district of Santa Barbara. The installation, which must be completed by April, 1924, will be supplied by foreign contract, and this, with all material and other supplies, are granted exemption from duties for five years.

In Nicaragua, the Masaya Dam, erected in connection with the Masaya waterworks, and power station, has now been completed. The capacity of the pumping plant is 600,000 gallons of water daily.

The Municipality of Atiquizaya, Republic of El Salvador, has resolved to erect, and to call for bids for an electric light plant at Ahuachapán.

Plans have been completed for the construction of a proposed power plant at Nacozari, State of Sonora, Mexico, the total expenditure being estimated at $600,000 Mex. (£60,000). The plans include the construction of a 40-mile high-pressure line from the plant at Las Chispas, the offices of which are situated at Nacozari.

The sum of 3,500,000 pesos is to be expended upon the electrification of the Northern Tramway of Montevideo. The line, which is at present worked by mule-traction, has recently been purchased by the Government, whose desire it is that the contract of construction should be undertaken by some responsible banking firm which would, at the same time, place bonds for the amount mentioned at a price not lower than 93 per cent., such bonds bearing 7 per cent. interest. The successful contractor for the loan would also receive the contract for the work, or, alternatively, this would be put up to public bids.

The municipal authorities of the city of S. Luiz do Maranhao (Brazil) have granted a concession, to cover a period of thirty years, to extend the existing light and power supply and to construct a system of electric tramways. The city, which has a population of approximately 53,000, is one of the most prosperous in the Republic.

Chile is being exploited as a field for wireless apparatus, the indications of a widespread market being strong. Immediately legislation, now under consideration, has been passed legalising the introduction of radio-telephony upon a large scale, a brisk demand for apparatus is certain to be met with. The legislation in question in all probability will be based on the laws of the United States. Although these do not provide specifically for broadcasting by private enterprise, it is possible that a service will be available through the leasing of Government-owned stations during the times of peace. British manufacturers interested in the Chilean market would do well to send—through their Consul—catalogues, printed in Spanish, and other descriptive literature dealing with their specialities.

The first standard-gauge railway in South America will shortly be electrified, thus constituting a work of the highest importance to future transport in that country. The stretch of line is 190 km. between Santiago and Valparaiso. The current is being supplied from one of the four sub-stations located at Pingue, Llay-Llay, San Pedro, and Viña-del-Mar.

Application has been made to the Provincial Government of Córdoba for a concession to cover the construction of a hydraulic plant sufficiently large to supply light and power to the city of Rio Cuarto and the well-populated surrounding territory of the Córdoba Province. The town of Rio Cuarto, situated 360 miles W.N.W. of Buenos Ayres, is on the Andine Railway, and has an industrious and thrifty population of 15,000. The introduction of an efficient and economical electric light and power plant has long been regarded as an urgent necessity, the existing current costing 58 centavos per kWh. The estimated cost of the energy to be supplied by the new plant is between 35 and 38 centavos. In addition to industrial purposes, for which it is anticipated a pronounced demand will be met with, the concessionaire will be called upon to supply light and power, without charge, to Government schools and other institutions in the district. Plans are being drawn up and will shortly be ready for the approval of the Chief of the Engineering Department, at the Ministry of Public Works (Córdoba). Provided the plans are passed the concessionaire will be called upon to commence work within 90 days of final sanction, and to complete the whole of the station and its equipment within a period of three years.

The Peruvian Government has authorised the construction of an electric car line to start at the Avenida Indústria, Lima, running parallel with Avenida Progréso, and connecting with the present system at either Bellavista or Callao. A second concession has been granted for the construction of an electric car line from Lima to La Punta, *via* Magdalena.

An hydraulic plant is to be constructed at Matil, 12 miles south-west of Quiruvilca, Republic of Peru. The plant is to be capable of generating 2,000 h.p. This forms part of the enterprise to be undertaken by the Northern Peru Mining and Smelting Co., of Lima, which holds a short option on the Quiruvilca copper mines, situated about 80 miles east of Salaverry, in the Department of La Libertád, and 50 miles from Menocucho, the present terminus of the Trujillo Railway.

The Federal District (Mexico City) will shortly complete a number of improvements with regard to public lighting. These will constitute the capital of the Republic one of the best-lighted cities in Latin America, a fact contributing largely to the safety which characterises all its thoroughfares at night. The additional plant will consist of 1,500 new lamps erected in central avenues, and the changing of the present lamps for those of higher power. The contract for public lighting in the Federal District is held by the Mexican Light & Power Co., Ltd.

The Tuxpango plant belonging to the Mexican Railway Co. is to be considerably enlarged in order to develop the additional power required for this undertaking. The company has recently re-appointed several of its old employés connected with the original plant, who have been instructed to return to Mexico to superintend the work of enlargement.

For the purpose of supplying power to its tin mines a Chilean company operating in Bolivia has constructed a hydro-electric plant. The curved concrete dam has a radius of 50 metres and a height of 58 metres. The power station has three 500-h.p. turbines, which drive 350-kW generators, the current being transmitted at 11,000 volts.

For the purpose of utilising the falls in the Mogyguassú River, in the State of Sao Paulo, a new electric power plant has been established in Rio Claro; 6,000 h.p. is developed by three turbines of modern type. The new facilities enable the plant to furnis hpower within a radius of 200 km.

Electric lighting plants are to be installed in the Canton of Esmeraldas and the Canton of Vinces, Republic of Ecuador. To pay for the work taxes will be levied on each vessel or small boat entering the port of the Canton, beginning in January of this year.

The contract for the electrification of the section of the Mexican Railway between Orizaba and Esperanza has been allotted to the International General Electric Co. Direct current at 3,000 volts will be furnished by the hydro-electric plant of the Puebla Light & Power Co., of Orizaba.

The contractors have undertaken to supply 10 engines, of 150 tons each, which may be utilised either for freight or passenger trains, together with equipment for sub-stations, trolleys, and supply stations. The total cost of this work is estimated at 2,500,000 pesos (£250,000).

Considerable hydro-electric developments in the Banda-Oriental are expected to follow investigations now being made by a Special Commission, composed of nine engineers, and appointed by the National Council of Administration of Uruguay. The Commission has been instructed to consider the possibility of utilising the water-power of the country to a much wider extent, and to discover if there exist any waterfalls which may be of industrial value to the country.

POWDERED COAL AS FUEL.

By J. T. DUNN, D.Sc., F.I.C.

(*Abstract of paper read before the* North-East Coast Institution of Engineers and Shipbuilders.)

In considering the combustion of coal, two points meet us at once as detracting from efficiency, or as requiring adequate arrangements to secure it. The first is that coal always contains mineral matter, which on burning the coal is left in the form of ash. The second point is that when coal is burnt in a furnace it does not burn away as a whole continuously, but gives off, as it heats up, large volumes of gaseous or vaporous combustible matter, and leaves behind a solid residue of carbon or coke; and the supply of air for combustion has to be so regulated that it can deal with the gaseous as well as with the solid products.

It is claimed that both of these difficulties are very much lessened, if not got rid of, and that many other advantages result, if, instead of the coal being burnt on grates in the solid form, it is finely pulverised, and injected into the furnace in the form of a stream of dust, mixed with the air which is necessary for its combustion. To-day large numbers of installations exist using solely powdered coal, especially in the United States, and in France. In 1919 there was used in the United States about 11 million tons of coal in the form of powdered fuel.

A typical installation for the burning of powdered coal includes arrangements for (*a*) breaking, (*b*) drying, (*c*) pulverising the coal, (*d*) transporting it to the furnace, (*e*) feeding it through the burner. The systems in use divide themselves sharply into two: (1) The unit system, in which the coal is pulverised at the furnace, so that there is a separate pulveriser for each furnace; (2) the multiple system, in which the coal is pulverised at a centre and transported as a powder to any number of furnaces that may be included in the installation.

Considering first a unit installation, typified by the turbo-pulveriser of the Powdered Fuel Plant Co., the coal, if not already small enough in size, is broken down by some form of crusher to about three-quarters of an inch cube, and is delivered to a hopper from which it falls into the distributor, which feeds it to the pulveriser continuously. The pulveriser consists of a series of disks fitted with loaded blades, which rotate on a common shaft in a casing divided into as many compartments as there are disks. The coal travels in succession through all the compartments, subjected in each to the breaking action of the blades, and passes through a fan on the same shaft as the disks into the pipe leading to the burner. The fan draws a continuous current of air through the pulveriser, which, of course, mixes with the coal dust drawn through. There are two air inlets, separately adjustable, one at the distributer end, the other between the pulveriser and the fan. The pulveriser is erected close to the furnace, so that there is only a short length of pipe to traverse to the burner.

The unit system is very compact, and is very useful where the installation is small and would not justify the capital outlay for a separate pulverising installation and transport system; but the cost of course increases almost proportionately with the number of furnaces to be fed. Another advantage is that unless the raw coal be very wet it can be used in the pulveriser without preliminary drying, for there are no great lengths of piping, no bins nor feed-screws, and hence there is little likelihood of clogging of wet coal occurring. The turbo-pulveriser does not pulverise the coal so finely as some of the pulverisers in other systems (in one instance 70 per cent. passed a 1/200-inch sieve and 88 per cent. a 1/100 inch) but the fineness is sufficient to ensure practically complete combustion of any ordinary coal. Nearly all the air needed for the combustion of the coal is drawn in by the fan and mixed with the coal before it reaches the burner; and it is possible to secure smokeless combustion with a great variety of coals.

In the multiple systems the first step, as in the unit system, is the crushing of the coal. Before pulverisation, however, the coal is in all these systems dried to such an extent as to leave not more than 0.5 to 1.0 per cent. of moisture in it. Not only is finer pulverisation secured by using dry coal, but the risk of stoppages caused by clogging is very greatly lessened. In nearly all the systems the drier consists of a long inclined cylinder, which rotates slowly on its axis, and down which the coal slowly travels. The cylinder is heated on the outside by a small furnace near one end, and the flue gases, after travelling along the outside of the cylinder and becoming cooled to a temperature at which it is safe to bring them into contact with the coal, then travel through the inside, and carry with them the water vapour which the coal gives off.

From the drier the coal goes to the pulveriser. Much stress has been laid on the need for extremely fine pulverisation. An inch cube of coal needs for complete combustion 6¾ cu. ft. of air, or a cube of about 22½ in. side; and as combustion can occur only where the coal and the air are in contact, all this air must come into contact with the surface of the cube, which begins by being six square inches and gradually diminishes, before the coal can be completely burnt. But if the coal be divided into smaller cubes of 1/100-in. side, there will be a million of these, their aggregate surface will be 600 sq. in. instead of 6, and if they be uniformly distributed through the 22½-in. cube of air, each will be at the centre of a little cube of its own, less than a quarter of an inch side: clearly the conditions here are more favourable to rapid and complete combustion than in the former case, even were the coal entirely combustible, still more so when it contains a percentage of ash. It is usually considered that the coal should be so finely powdered that 95 per cent. of it will pass a sieve with 100 meshes to the inch and 80 to 85 per cent. will pass one with 200. Generally, the finer the grinding the more rapid can the combustion be made; but also, of course, the more power will there be needed for the grinding. In some cases rapid combustion and a short, hot flame may be desired; but in others a slower and longer flame may be preferable, and in such cases probably rather less fine grinding may be sufficient.

For the transport of the powdered coal from the pulveriser to the furnace burner various methods are adopted. The earliest was the use of screw conveyors, which for short distances are quiet efficient, and are not liable to get out of order. The coal from the pulveriser is raised by a current of air or by an elevator into a collecting bin at a suitable height, from the bottom of which it is discharged into the screw conveyor leading to the bin at the furnace.

More recently pneumatic transport has been developed, in which the coal is made to flow through pipes by air pressure. The finely pulverised coal particles entrain, or "adsorb" on the surfaces, a considerable amount of air (a given volume of pulverised coal contains only 46 per cent. of actual coal, and 54 per cent. of air by volume), and have almost the same freedom of flow as a liquid.

Where storage bins exist at the furnaces, the coal is usually taken from them by a screw conveyor, which drops it into the tube of the burner. Here it is mixed with the "primary air," usually injected into it from behind, which carries it along into the furnace. This mixture does not usually contain the full amount of air needed for complete combustion, and "secondary air" is introduced, sometimes by suction on the injector principle, sometimes from a separate blower. Usually this is introduced concentrically with the air and fuel mixture; in some burners the mixture comes through the central pipe, the secondary air through the surrounding annulus, in others the situation is reversed; and a great variety of devices exists to secure proper mixture of fuel and air, easy regulation of proportions, and appropriate velocity. In the early installations troubles and failures frequently occurred through too high speed of the entering mixture; and the aim now is to secure as low an entering velocity as is consistent with the quantity of fuel to be burnt, and as will prevent any flame from carrying back into the supply tube.

Advantages: (1) The complete combustion of powdered fuel can be secured, with very little more than the theoretically needed quantity of air, so that the highest possible temperature of combustion may be realised, and the least possible loss of heat from the installation, due to the escape of the products of combustion at a temperature above that of the air, will occur. The combustion is almost the same as that of a gaseous fuel. Further, the combustion is more nearly complete than that of coal burnt in the ordinary way, in that not nearly so much of the fuel remains unburnt in the ashes.

(2) The speed of entry of the fuel, and the proportions of fuel and air, can be varied readily so as to obtain the best conditions of combustion, and utilise to the best advantage the heat evolved, according as a long and gentle, or a short and intensely hot flame is desired. The same ease of regulation makes it possible too, whilst not introducing excess air to any extent, to secure rapidly completeness of combustion and freedom from smoke, even if the coal should vary considerably in quality.

(3) The full flame is at once available on starting and the heating-up of a furnace starting from cold is much more rapid than with solid fuel. Combustion is stopped the moment the supply of fuel is shut off, and no waste of further fuel takes place. There are no losses through the banking of fires, and variation of the rate of combustion to meet varying loads can be readily effected.

(4) The lessened interference of the ash with the process of combustion, when the fuel is finely powdered, allows of complete combustion even when the percentage of ash is very high; and many fuels can be completely and economically burnt in pulverised form, which it would be impossible to utilise in the ordinary way. In this possibility of using inferior fuels, powdered coal holds out promise of great economy in the future.

(5) In large installations especially, there is a marked saving in labour effected by the use of powdered fuel.

Disadvantages: (1) In solid-fuel furnaces, the ash remains on the hearth; but with powdered fuel it is first formed as a fine suspended dust, which will tend, of course, to settle out, but from its fineness will largely be carried on with the products of combustion and be liable to deposit on boiler tubes. Further, these particles of ash, if the ash be readily fusible, may coalesce and fall on the furnace hearth as a melted and viscous slag. In early installations, much trouble arose from this cause; but through modifications of the form and size of the combustion chambers, and through lessening of the velocity of the entering fuel and air, the trouble has now been very greatly reduced.

(2) Early experience showed that the high temperature of the flame was very destructive of furnace linings, the bricks melting down under the combined influence of the high temperature and the mechanically abrasive and chemically destructive action of the ash particles which scoured along them; but the same improvements, and the device of introducing a little excess air along the walls of the combustion chamber, have greatly mitigated the evil.

(3) A mixture of coal dust and air in certain proportions is explosive, and explosions have occurred in powdered-fuel plants. But investigation has shown that these explosions have in all cases arisen from causes which were preventible, and not inherent in the nature of the operations carried on in the plant; and the possibility of explosion in a well-designed plant which is properly inspected and kept in order is very remote.

Costs: It is very difficult to obtain trustworthy figures of the cost of powdered fuel equipment which will hold good in this country. Herington, in his book on powdered fuel, gives an estimate of costs of powdered fuel as compared with actual costs of side feed stokers in a Canadian installation of eight boilers of a total horse-power of 4,900. The daily requirements were put as follows:—

	Solid fuel. Dollars.	Powdered fuel. Dollars.
Coal	1,440.00	1,356.00
Labour	402.72	171.12
Power	0.98	25.31
Repairs and supplies	3.30	7.57
	1,847.00	1,560.00

and showed a daily saving of 287 dollars, equivalent to 88,970 dollars per annum.

The complete cost of the necessary powdered coal equipment, including building, motors, changes in boiler furnaces, and erection, was put at 138,000 dollars; and assuming fixed charges as being 15 per cent. of this total cost yearly, or 20,700 dollars, the net annual saving would be 88,970 less 20,700, or 68,270 dollars, nearly 50 per cent. on the capital outlay.

ELECTRICITY IN IRON AND STEEL WORKS

Discussion.

During the course of the discussion on Mr. C. A. Ablett's paper on the above subject (which was abstracted in our issue of May 11th) at the annual meeting of the Iron & Steel Institute

Mr. Walter Dixon said, regarding the use of mixed-pressure turbines, that while having done good work in some cases, there were instances in which the results had been disastrous from the economic point of view. The author also made some wise remarks as to the use of gas engines, but after all one had to remember that the primary object of steel works was to make steel and not electricity. He appreciated that, given the conditions mentioned in the paper, with gas and exhaust steam available, electricity might be generated more cheaply than it could be bought; at the same time there were considerations which had to be taken into account which had not been mentioned in the paper, before a final conclusion could be come to. There was a great deal of self-evident wisdom in the paper, but it was the application of such wisdom which was the important thing in the particular circumstances.

Mr. F. Clements said that the comparison of the cost of power depended upon the size of the plant; he presumed that a fairly large capacity steel works would not demand much more than 6,000 kW from the generating station and that had an important influence on the size of set dealt with in arriving at the figures in the cost tables. The figure in the paper under the heading of "water, oil, and stores" for the steam plant with a load factor of 65 per cent. was 0.02d. per kWh, whilst for the same load factor for the gas engine plant, the figure was 0.03d. per kWh. Did the author, in the case of the steam plant, include the cost of preparing the boiler water and dealing with condenser water, because the figure of 0.02d. seemed on the low side? He had recently seen some of the latest type of gas engines made in Belgium by Messrs. Cockerill (they were running as sets of 6,000 kW) which he believed were the largest gas engines in the world—and as an example of the highest class of mechanical engineering these engines were unsurpassed. This development had taken place largely due to the fact that the builders had adopted the policy of increasing the average temperature throughout the cylinder; instead of working at a normal mean effective pressure of, say, from 60 to 65 lb. (the usual maximum) they had used from 80 to 85 lb. with a consequent increase in the power developed from the same size cylinder. This would result in the capital cost for a given power being materially reduced.

Mr. L. Rothera, referring to the driving of mills, said that from the electrical point of view there was always very great anxiety that the electrical plant should be extraordinarily efficient. A matter of one per cent. was considered a large difference between two tenders for electrical plant, but such a difference in efficiency in the electrical drive was absolutely negligible compared with the losses which might take place in the rolling mill. The paper showed very clearly that there might be a 50 per cent. increase in the friction losses of a mill, and one of the advantages of the electrical drive was that such an increase would be immediately detected on the instruments and a rectification of the alignment of the mill plant would bring the friction losses back to their original amount.

Mr. Frank Anslow did not think that people who were responsible for the management of steel works were fully alive to the importance of load factor, which had a very great bearing upon the question whether exhaust steam should, or should not, be used. The author had said that the load factor of a steel works was in the neighbourhood of 65 per cent. Most iron and steel works were connected with collieries, and the colliery load factor was not nearly so good as that of the steel works. The combined load factor was only about 35 or 40 per cent. and, if 45 per cent. was obtained, it was a very good load factor. Therefore, where the steel works were being supplied from the power plant also supplying the colliery, the load factor would necessarily be below the figure mentioned by the author. A saving of 15 per cent. in the coal bill did not necessarily mean a saving of 15 per cent in the power bills. There was a great tendency to use powdered fuel and he agreed that, under the right conditions, its use would be a great asset to many iron and steel works, but there was a tendency to overdo the use of powdered fuel without due consideration of the load-factor problem.

Mr. C. A. Ablett, in replying to the discussion, said that the size of the plant dealt with in the two tables mentioned by Mr. Clements was 6,000 kW, actually running, and 50 per cent. reserve, or 9,000 kW in all. The capital charges had been taken on the whole of this plant. As to the "oil, water and stores," the figures had been brought down to the nearest place of decimals, but if they had been taken to a larger number of places of decimals, they would have been slightly different in the direction indicated by Mr. Clements. It was assumed that the water available for the boilers was fit and did not involve treatment, and the figure included the cost of the cooling tower plant. The information as to the large gas engines in Belgium foreshadowed a decrease in capital expenditure not only on the gas engines for a given power, but also all through the installation, and must eventually lead to a reduction in the cost of power by the use of gas engines. Obviously, the load factor of five mills would be better than that of one, but there were other things to be considered, and he had known instances in which means of working the plant had been found which materially improved the load factor.

Painting v. Galvanising.—In the *Electrical World* of April 28th, the results of an inquiry into the relative merits of painting and galvanising outdoor steel structures are reported. Practice is very diverse, but broadly speaking, galvanising is preferred for towers, as it lasts for 8-15 years, whereas paint lasts only for 2-4 years, and repainting near live wires is dangerous to life. Galvanising adds about one-third to the first cost of the steel, but in the long run may be cheaper than painting; on the other hand, lighter sections may be used if galvanised. In a damp, salty, or sulphur-laden atmosphere, galvanising has a very short life. Painting seems to be more widely used. The quality of both galvanising and paint is very important. Isolated structures are preferably galvanised. Some companies which have used aluminium paint, with a suitable vehicle for the aluminium powder, have found the results most satisfactory and encouraging. Hot galvanising is very much superior to cold galvanising. The opinions of many correspondents are given in full, and contain much valuable information. One states that increasing the thickness of all parts by ½ in. cost less than the galvanising of the thinner metal.

Electric Vehicles in Sweden.—Electric motor vehicles are gaining ground in Sweden. The *Dagens Nyheter* reports that Aktiebolaget Stockholms Bryggerier (Stockholm Brewery Co.), which has been using electric motor lorries for the past three years, is very satisfied with these vehicles, and has ordered a new lorry designed by Elektrobilaktiebolaget and manufactured by the Allgemeine Elektrizitaets Gesellschaft at Berlin. Elektrobilaktiebolaget is also ordering for the purpose of trial an electric motor 'bus from Messrs. Luthoch Rosen, of Stockholm. —*Reuter's Trade Service* (Stockholm).

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A New "Creda" Cooker.

Messrs. Baxter & Caunter, Ltd., 219, Tottenham Court Road, W.1, are selling a new model of the "Creda" cooker, the principal advantage of which is its changeability of parts.

The body is of sheet steel 1/16 in. thick, mounted on cast-iron legs, and the top is of ¼ in. steel and very rigid. A sheet steel interior which can be easily removed is provided, which ensures that the elements are entirely protected from

Fig. 1.—New "Creda" Cooker.

grease, &c. The elements are arranged in groups, each single element being of the flat mica type wound for a 100-W consumption. These groups are arranged in parallel generally at the sides, though they may be fixed at the top and bottom if this is preferred. The fixing of the elements is carried out in a very substantial manner; they are fitted to 1 in. x ⅛ in. iron busbars running down the sides. In this way replacement is facilitated; it is only necessary to loosen the

Fig. 2.—The Cooker Dismantled.

fixing screws, remove the damaged element, and slip another in its place. Being wired in parallel, the failure of one element does not cut out the rest.

In the top are a grill and two hotplates. The latter may be of either the closed or open pattern. Between the top of the oven and the top plate an enamelled tray is fitted. This can be drawn out to form a table or to inspect the food being grilled. The grill and hot plate elements are of coiled nichrome wire mounted on firebrick bases. The two hot-plate elements and the grill element are fitted into separate trays, and when it is necessary to replace an element the whole tray is removed and replaced by the suppliers and the damaged element repaired at their shops. This is a "service" feature of great value and likely to give the customer confidence in the cooker.

The connections, fuses, and switches are contained in a chamber at the side of the cooker. Upon the removal of the top, the cover of this chamber can be swung over exposing the whole of the gear. The connections are of solid wire, no beaded work being employed whatever. The grill and smaller hotplate have one "heat" only. The larger hotplate and the oven are arranged for three "heats," and beneath the switches a plug is provided to which a kettle or other appliance may be connected.

The internal dimensions of the oven are:—Height, 17½ in.; width, 14 in.; and depth, 15 in. The exterior height is 39¾ in.; width, 20¼ in.; and depth 17½ in. The loading of the cooker with open type boiling plates is 5,150 W, made up as follows:—Oven, 2,000; large hot-plate, 1,250; small hot-plate, 650; grill, 1,250. With the enclosed hot-plates the loading of the smaller plate is increased by 100 W.

Fig. 1 is a view of the exterior of the cooker, and fig. 2 shows the removable interior, the top-plate removed, the arrangement of the grill and boiling ring elements in trays, and the connections at the side.

Floor Waxer and Polisher.

The Canadian Electric Floor Waxer and Polisher Co., Ltd., 22, Mark Street, Toronto, Canada, is marketing a model with several improvements (fig. 3). The case of this model is constructed of aluminium and a powerful universal motor is employed. It carries a waxing pad, 3½ x 6½ in., which is faced with perforated leather, through which the wax is forced by powerful coiled springs. This model covers a strip 8¼ in. wide and polishes close to the baseboard.

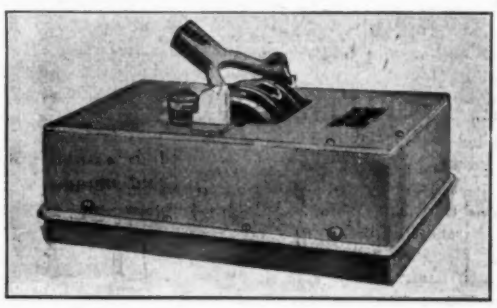

Fig. 3.—Floor Waxer and Polisher.

The original model operates on the revolving disk principle for all operations. The new model operates on the cylinder principle. The disk type is, perhaps, best adapted for floors that are absolutely level; the cylinder type is better adapted to take care of floors that are grooved or wavy. The two "Sun" models do the work quickly and run so easily that a child of ten can operate them.—*Electrical News* (Toronto).

The "Greenhalgh" Cable Connector.

Mr. James Greenhalgh, of Manchester, has devised a method of coupling cables which he claims to be far superior to the

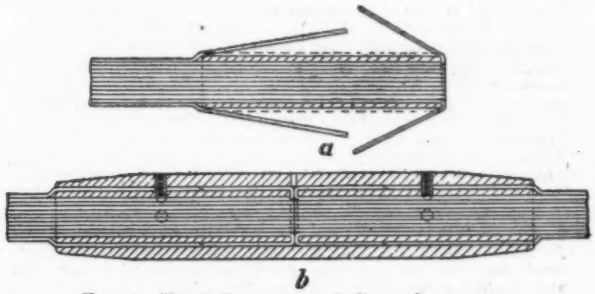

Fig. 4.—The "Greenhalgh" Cable Connector.

standard types of connectors. The connector and the method of using it are shown in section in the accompanying illustrations (fig. 4). There are three parts: An outer sleeve of copper bored to receive the cable—either right through as shown, or

from both ends, leaving a solid partition in the centre; and two copper ferrules bored to slip easily over the second ring of strands. In use, the first ring of wires is lifted and a ferrule is placed over the cable ends with a short portion projecting through. The ends of the second ring are then bent back over the outside of the ferrule forming an anchoring. The outer ring of wires is then forced down upon the exterior of the ferrule in line with the bent-over ends of the second ring of wires. The ferrules are thus completely enclosed by the wires, and they are inserted into the outer ferrule. The strands are held by a number of grub-screws or pins inserted through the wall of the outer sleeve. If necessary extra holes for the pouring of solder, to make a "sweated" joint, can be provided. The completed joint is shown in fig. 4*b*.

Tests carried out at the Manchester Municipal College of Technology recently, showed that the conductivity of cables thus jointed was greater than that of an equal length of the cable. A sample joint on a 0.15 sq. in. conductor was subjected to a tensile strain and parted at 2.15 tons.

EARTHING THE NEUTRAL POINT.

By S. AUSTEN STIGANT, A.M.I.E.E., M.Am.I.E.E., Mem.J.Inst.E.

(*Abstract of paper read before the* Junior Institution of Engineers.)

This short review of the theory and practice concerning the neutral point earthing of h.p. and l.p. three-phase systems points out the advantages of and the steps taken for earthing under different conditions.

The Insulated Neutral Point.—On a system operating with an insulated neutral the fault most to be feared is a breakdown to earth on one phase, particularly if it takes the form of an "arcing ground" at an overhead line insulator. From such a fault pressure waves proceed along the line in both directions, and it is no uncommon occurrence for secondary breakdowns to take place simultaneously at points on the system widely apart. There is reason for apprehension even when the system consists purely of underground cable, though an earth fault in a three-core cable is generally quickly converted into a short circuit between phases, and the cable then becomes isolated from the supply.

It has been submitted that the great advantage of operating with an insulated neutral is that, should an earth fault occur on one of the lines, the supply need not immediately be interrupted, but can be continued until the fault has been located and a suitable opportunity arises to permit the repair. In actual modern practice this reasoning is entirely fallacious, for the process of location may often be a lengthy procedure, and the insulation of apparatus connected to the system is being overstrained during that time. Operating with an insulated neutral has been responsible for numerous breakdowns of cables, generators, and transformers, and such practice is definitely not to be recommended.

The Earthed Neutral Point.—The advantages are manifold: (1) Persistent "arcing grounds" are eliminated, and an earth fault becomes definitely converted into a short circuit from line to neutral; h.p. oscillations are reduced to a minimum, and consequently the factor of safety of the system against earth faults is largely increased. (2) It secures the maximum effectiveness of automatic protective gear immediately an earth fault occurs. (3) H.p. shocks to the system and apparatus connected thereto are reduced to a minimum; it is possible to effect appreciable reductions in the insulation to earth of cables and overhead lines, which produce a corresponding saving in cost; also in transformers and generators, but in practice this is carried into effect only in very-high-voltage transformers in which the insulation is graded down from the line terminals to the neutral point. A dead earth fault on one line of a system having an insulated neutral raises the pressure of the two sound lines, and apparatus connected to the lines will eventually fail from cumulative weakening action; in very-high-voltage systems the pressure of the two sound lines may, at the first instant of the fault, reach twice the normal line pressure. (4) It is usual to insert some current-limiting device between the neutral point and earth, but the American power companies transmitting at the highest pressures are in most cases operating with the neutral point dead earthed, largely due to the fact that while considerable amounts of power are being transmitted, the transmission voltages are so high that the fault currents are not sufficiently large as to produce such electromagnetic stresses as cannot adequately be taken care of by more or less simple provisions in the mechanical design of the apparatus concerned; in addition, overhead lines embody an appreciable amount of inherent reactance. (5) It prevents overhead lines being subject to induced static charges from adjacent charged clouds, dust, sleet, fog, and rain, and changes in altitudes of the lines, and the gradual accumulation of high "floating" potential above earth. The h.p. neutral is earthed mainly for the sake of the protection of the system, while the l.p. neutral is earthed chiefly in order to reduce the possible danger to human life.

Neutral Earthing Apparatus.—While the insertion of some current-limiting device is beneficial from the point of view of reducing fault currents, it should be remembered that the sound lines may, for a short period of time, be subject to pressures higher than the normal phase pressure, the effects of which, however, if the automatic protective gear operates sufficiently rapidly, are not of serious import.

By far the most common h.p. device used is some form of resistance which is usually air cooled, but on the European continent they are sometimes immersed in oil. While resistances tend to damp out surges, they are usually a source of intense dissatisfaction from the point of view of both price and bulk. Ordinary grid or wire resistance possesses a positive temperature coefficient, so that if the initial fault current is not sufficiently great to operate the relays, the fault will persist, and possibly cause more extensive damage; if, however, the value of the resistance is chosen to allow sufficient margin over the heaviest current required to operate the least sensitive relay, this disadvantage is more apparent than real.

There is available, however, a resistance having a negative temperature coefficient, and it is claimed for the Brazil carbon-powder resistance that the fault current need never exceed the current necessary to trip the least sensitive relay, but it is the opinion of certain operating engineers that if the first kick of the fault current does not trip the relays, a gradually increasing current will certainly not do so, but instead, the fault will be prolonged and the damage become more extensive. At least one important electricity undertaking earths its e.h.p. neutral point through a large water resistance (rated at 20 ohms, the line voltage being 20,000), and this has given every satisfaction. The water is stationary, and the apparatus must not be confused with the smaller water-jet earthing resistances often used on the European Continent.

In Great Britain untuned reactance coils have been used to some slight extent for earthing generator neutral points, generally multi-core lead-covered cables cast in concrete, the multiple cores inside the single lead sheath being all connected in series to form the total number of turns necessary to give the desired reactance, and connected to the circuit by means of a single-core lead-covered cable. Another type consists of bare stranded conductors wound upon an insulating frame and enclosed by protecting porcelain blocks.

On the European Continent, and to some extent in America, generator neutral points have been earthed through tuned or partly-tuned reactance known as Petersen earth coils and dissonance coils respectively. The coils are designed to resonate at fundamental frequency more or less exactly with the resultant capacity of the system when an earth fault occurs on one of the lines. As the coil is in parallel with the resultant capacity of the system, a large current will circulate through the earth coil and the line capacities, but the current flowing through the actual fault will have a very small value only, as it is the vector difference of the two currents, which are almost 180 deg. out of phase with one another. There is difficulty in accurately resonating the earth coil with the line capacities under *all* fault conditions on long high-voltage lines, and as a consequence it appears to be limited to systems employing medium-pressure lines of relatively short lengths. In practice it is not necessary to obtain close resonance for satisfactory operation, and coils having as much as 50 per cent. dissonance have provided the necessary protection.

The external appearance of the coil is similar to that of a static transformer having section wound coils. It has an air-core single winding only, which may be provided with tappings so that the reactance can be varied. The coil is oil-immersed in an ordinary transformer tank.

Multiple Earthing.—In Great Britain the Board of Trade prohibits earthing at more than one point of extra-high-pressure systems, but as a result of experience in the U.S.A., it is the considered opinion of many responsible engineers in Great Britain that the restrictions imposed by the Board of Trade are unnecessary and should be removed. If multiple earthing were adopted *thoroughly*, the relatively large number of parallel paths available for the flow of harmonic currents would doubtless cause no real telephone disturbances on account of the diffusion and consequent weakening of harmonic current in the distributed paths.

LEGAL.

Tomlinson Lee v. Peel.

SLANDER ACTION BY ELECTRICAL ENGINEER.

(*Concluded from page* 730.)

The hearing was resumed on May 8th.

DEFENDANT, re-examined, said he never had any personal feeling against plaintiff. For years they had all been trying to help him. That had been the main object of their refusing to speak at the Council meetings. They felt it might injure him, and they were doing it now only because they were forced.

Mr. A. W. HICKMOTT, grocer, of Merton Road, Wimbledon, said he was a member of the Corporation and Electricity Committee. He was present at the Gerrish interview, as well as at the Temple interview, and what defendant said was that they had lost confidence in plaintiff.

Mr. SHELDON, recalled by Mr. Gregory for the defence, said that on one occasion plaintiff said, "He was not going to be 'downed' without a fight. He would see the works were shut up and no 'juice' would go out."

Alderman D. STEWART, of Cambridge Road, Wimbledon, a member of the Institution of Electrical Engineers, and chairman of the Electricity Committee from 1910 to 1917, had nothing to say up to that year of plaintiff's work. He had never seen him the worse for drink, but certainly under the influence of drink. He gave a testimonial to plaintiff as to his technical ability.

COUNSEL: Would you be prepared to repeat that testimonial now?—No.

Cross-examined, witness said that while he was chairman of the Electricity Committee he had no complaint as to plaintiff's engineering ability or management of the business.

The hearing was adjourned, and was resumed on May 9th, when more evidence was given for the defence.

Mr. T. G. MYNOTT, a stockbroker, said he voted for Mr. Lee's dismissal with much regret.

Mr. S. ALLEN said he had been a member of the Electricity Committee and chairman for some time in 1919. He was always anxious to work with Mr. Lee, but in recent years he found it impossible to do so. The day after he was elected chairman of the Electricity Committee he saw Mr. Lee at the works. He said: "Good morning, Mr. Lee," and plaintiff said: "If you want a b—— row, you can have it." He told him that he wished to work amicably with him in the interest of the business. He gave plaintiff no occasion for his conduct towards him.

Alderman J. S. H. ABBOTT, wine and spirit merchant, and a member of the Electricity Committee, said that Mr. Lee's disposition to the Committee was hostile, and he resented inquiries and questions. He arrived at the conclusion that Mr. Lee should be dismissed notwithstanding that he had friendly motives towards him.

Mr. R. W. KLITZ said he attended on subpœna. Before the war he was in the employ of the Wimbledon electrical department. In 1911 he recollected an incident when Mr. Lee was his superior officer, and he asked for his orders in writing.

Mr. GREGORY: What was happening to Mr. Lee?—He was rather intemperate.

Why did you require an order in writing to obey his orders?—Because Mr. Lee was in the habit of giving orders when he was not in a condition to give orders.

On one occasion, witness alleged, Mr. Lee suggested that a live wire at 2,000 volts should be put round the works.

Before he joined the Army in 1915, witness said, Mr. Lee had changed. He had given up drink and smoking.

Mr. R. V. TREACHER, an accountant in the employ of the Wimbledon Town Council, gave evidence as to the alleged suggestion about the live wire. Witness said Mr. Lee said: "Mr. Klitz, we have orders to protect the works against German spies and other people. I want you to put a live wire round the works."

Mr. GREGORY: What was his condition?—I should say Mr. Lee at the time was getting over the effects of drink. Mr. Lee was frequently under the influence of drink.

The hearing was adjourned.

On May 10th, Mr. MADDOCKS, K.C., for the plaintiff, called evidence in rebuttal of the evidence given for the defence.

Mr. ARTHUR NICHOLS MOORE, electrical engineer to the borough of Newport, Monmouthshire, said he was at the Electrical Engineers' Convention at Bradford, in June, 1920, and sat opposite plaintiff at the luncheon. Plaintiff's condition was perfectly normal, and plaintiff was quite sober. He had seen Mr. Sparks's reports on the Wimbledon electrical undertaking, and Mr. Lee's observations on the reports, which indicated to him clearly that where Mr. Sparks and Mr. Lee differed was really a case simply of a difference of professional opinion. In general, Mr. Lee's observations indicated to him that Mr. Lee was thoroughly competent.

Mr. WILLIAM M. SELVEY, consulting engineer, and technical adviser to the Coal Controller for Yorkshire, said he had read Mr. Sparks's report and Mr. Lee's observations on it, and formed the opinion that Mr. Lee must have been a very competent engineer.

Mr. WILLIAM J. OSWALD, electrical engineer, said he entered the service of the Wimbledon Urban Council in 1904. He was still in the employment of the Wimbledon Corporation. From 1904, Mr. Lee was his chief. He had never seen Mr. Lee the worse for drink at the works, and when members of the Council or of the public visited the works he was always very courteous and willing to give them information. He had never heard any allegation about a live wire.

Witness (cross-examined) said he had heard Mr. Durling's evidence, and it was not correct. The water treating plant was used to the best advantage, but there were difficulties. They used the River Wandle water, but that water had been gradually getting dirtier.

Re-examined: Witness said that during the war there was a difficulty in getting suitable coal and that affected the boilers. Mr. Lee did not neglect his duties as to the cleaning of the boilers. Every effort was made to make the water-softening plant effective.

Mr. CHARLES HENRY WORDINGHAM, consulting engineer, said he had read Mr. Sparks's report and Mr. Lee's comments upon it. He saw no evidence of negligence or incompetence on the part of Mr. Lee in what Mr. Lee said. There was divergence of views among engineers on the ways of solving problems, and there was justification for what Mr. Lee recommended.

Mr. CLIFFORD H. ARMSTRONG said that in June, 1920, he represented his firm at the Bradford Convention. Mr. Lee was absolutely sober there.

Mr. F. T. JENKINS said he was a wireman and had been in the employ of the Wimbledon Corporation for many years. He drove the car for Mr. Lee up to Mr. Lee's dismissal He had never seen Mr. Lee the worse for liquor.

Mr. J. W. JOHNSON, clerk to the Maldens and Coombe Council said he had known plaintiff for many years and had never seen him under the influence of drink.

Dr. VINCENT GREEN said he had known Mr. Lee seven or eight years. There was no trace that Mr. Lee was a heavy drinker, and it would not be fair to say that he was.

This concluded the evidence, and Counsel addressed the jury.

In his summing up to the jury, his LORDSHIP said this was an action brought to recover damages for defamation of character and not a question of damages for wrongful dismissal. If he were wrongfully dismissed plaintiff could have brought an action against the Corporation. He understood that plaintiff did so; the case did not go to trial, as it was settled between the parties. They also knew that he brought another action against a Mayor and got £250 damages. Defendant had nothing to do with that. Plaintiff had brought actions against two other persons. It might be he would get money from them; that had nothing to do with Mr. Peel. Plaintiff's counsel said that the present action was brought to clear his client's character. Had not his character been cleared? If his character had been besmirched by one of the Mayors, that matter was investigated for two days and plaintiff was successful, and his character cleared. Would that be enough? They knew that there were actions against two witnesses called in that case. He said that because it was within their province to consider all those things when they considered the question of damages. As to the statement made at the Town Council meeting, on March, 1922, of which complaint was made, those words were spoken on a privileged occasion, and there would be no right of action unless plaintiff could satisfy them that the words were spoken with malice. Defendant said they were true. Defendant said he did not say the words which were alleged to have been uttered at the South-Western Hotel, Wimbledon, and he also denied speaking the other words complained of. Mr. Temple said he could not remember any particular words defendant said. If defendant did not speak the words, did Mr. Hickmott speak them by the authority, express or implied, of the defendant? In that case there were really four actions for slander in one.

The questions which his Lordship left to the jury, and the jury's answers were as follows:—

(1) Did the defendant, at a meeting of the Wimbledon Town Council, on March 6th, 1922, speak the words complained of, or words to that effect?—Yes.

(2) If so, were the words spoken true in substance and in fact?—No.

(3) In saying what he did, was the defendant actuated by malice against the plaintiff?—Yes.

(4) Did the defendant, at the South-Western Hotel on the 5th of March, 1922, speak the words complained of or words to that effect?—Yes.

(5) If so, were the words spoken true in substance and in fact?—No.

(6) Did Mr. Hickmott, in the defendant's presence, speak to Mr. Temple the words complained of, or words to that effect?—Yes.

(7) If so, did Mr. Hickmott speak them by the authority, express or implied of the defendant?—No.

(8) Were the words spoken on this occasion true in substance and in fact?—No.

(9) Did the defendant speak to Mr. Gerrish the words complained of, or words to that effect?—No.

(10) If so, were the words spoken on this occasion true in substance and in fact?—The words were not spoken.

(11) Damages as to words complained of?

(*a*) £100; (*b*) £20; (*c*) £50; (*d*) £20.

The jury were absent an hour and a half considering their verdict. As his Lordship had left the Court, judgment was not entered that night.

The case came before Mr. Justice Darling on May 14th for judgment to be entered on the findings of the jury.

Mr. Maddocks, K.C., in asking for judgment for the plaintiff for £120 damages with regard to the issue raised in questions 6, 7 and 8, as to whether words were spoken so as to bind the defendant, said that defendant would probably get any costs to which he was entitled in time, but on the further issue counsel submitted that defendant was not entitled to any costs because there was not any cross-examination.

Mr. J. D. Cassels, K.C., for the defendant, asked for costs on the issues on which plaintiff had failed.

His Lordship gave judgment for plaintiff for £120 damages, with costs on the issues on which he had succeeded, defendant having costs on the issues on which plaintiff failed. Defendant was given a stay of execution on terms.

Handcock & Dykes v. Tate and Another.

In this action, which was commenced in the King's Bench Division, before Mr. Justice Coleridge, on May 11th, Mr. Thorne Drury, K.C., in opening the case for the plaintiffs, said the claim was for professional services by a firm of consulting engineers, amounting to £141, and there were various charges of incompetence and misconduct raised by the defence against the plaintiffs and the defendants counterclaimed for £226, which they said represented damages which they had suffered owing to the alleged misconduct and incompetence.

The defendants were two ladies who kept a school for girls at Bushey, Herts., and the matters in question in the action related to an electrical installation. The members of the plaintiff firm were Mr. Dykes, M.Inst.C.E., M.I.E.E., and Mr. Townend, a retired engineer from the Royal Navy. He joined the plaintiff firm in 1919 and was admitted as partner in 1921.

One of the two defendants called upon plaintiffs at their offices in Westminster and told them that she and her partner desired to have electric light installed in their school buildings, which were of considerable extent and divided. They saw Mr. Dykes and Mr. Townend. One of the complaints made against the plaintiffs was that there was an expressed term that Mr. Dykes should personally prepare the specification and estimate, and that the whole work should be solely under his personal direction. Mr. Dykes told the lady that as he was about to start on his holiday, Mr. Townend, his partner, would supervise and look after the work. She was quite agreeable that this should be done, and afterwards, almost without exception, the correspondence was conducted by Mr. Townend personally, and he went down frequently to discuss with the defendants the details of the work to be done. At first there was a general discussion as to what was to be done and Miss Tanner told plaintiffs that she had recently had some portion of the premises redecorated and it was not desirable that the walls should be cut more than could be helped. They therefore discussed two possible systems of installation. One was that flexible wires should be carried round the doors and other corners, so as not to cut into the surface of the walls, and that was recommended as being much cheaper. The alternative scheme necessitated the channelling of the walls for the purpose of carrying the wires. After some discussion it was decided that the flexible wiring system should be adopted. Subsequently Miss Tanner said that she desired to control from her bedroom all the lights by means of a switch, and it was explained to her that that would be inconvenient and expensive and Mr. Townend told her that she would be able to control a certain number of lights and that other lights might be left available for special purposes. A week later it was decided that the idea of having all the lights controlled from one room should be abandoned. About September 4th the ladies again changed their minds and decided that they would not have the flexible wiring system but would have wires in metal tubes. These changes of mind (said counsel) were the cause of the whole trouble which had given rise to the action.

Evidence was given for the plaintiffs by Mr. Dykes and Mr. Townend denying that the defendants were told that the work could be done for £1,000. Mr. Dykes denied that it was agreed that the estimate was to be inclusive of everything.

The hearing was adjourned to the 14th inst., on which day Mr. Justice Coleridge was unable to sit owing to illness, and the hearing was further adjourned until next term, which commences on May 29th.

British Thomson-Houston Co., Ltd., v. Yorkshire & District Electric Lamp Repairing Co., Ltd.

In the Chancery Division, on May 11th. Mr. Justice Sargant heard this action against defendants, of Saxon Road, Sheffield, for infringement of the plaintiffs' patent for gasfilled lamps. The defendant company was not represented. Sir Arthur Colefax, K.C., Mr. Hunter Gray, K.C., Mr. Whitehead, K.C., and Mr. Trevor Watson appeared for the plaintiffs.

Sir Arthur Colefax said the validity of plaintiffs' patent was not in question, and the only issue was as to infringement. The action was brought to restrain infringement of plaintiffs' letters patent 10,918, of 1913, for improvements in incandescent electric lamps, the patent being that for gasfilled half-watt lamps. What defendant had done, and apparently claimed to continue to do, was to take a gasfilled lamp, the filament of which had broken, to open it, put in a new filament, fill it again with gas, and then say that it was merely a repair which was permitted and which was not an infringement.

His Lordship asked if the lamps were originally made under plaintiffs' patent.

Sir Arthur said this was not so in all cases.

Evidence was given as to the purchase of six lamps from the defendants, and Dr. Oberlander, consulting chemist, stated that he opened two of the lamps in which there was a tungsten filament coiled, and gas of low conductivity and relatively high pressure. The reconstructed lamp differed somewhat from the gasfilled lamp, but it was substantially the same. Witness added that it was impossible to repair a broken filament, and in order to make a gasfilled lamp within plaintiffs' specification, they would have to construct a new lamp.

His Lordship granted the injunction asked for, with an inquiry as to damages, costs, and an order for the delivery-up of the infringing articles.

Madras Electric Supply Co., Ltd., v. P. & O. Steam Navigation Co.

In the Commercial Court, on May 9th, Mr. Justice Bailhache heard this action, in which plaintiffs claimed damages in respect of a stator carried on one of the defendants' vessels to Madras, and which was dropped into the harbour while being taken off the ship.

Mr. Wright, K.C., who, with Mr. Langton, appeared for the plaintiffs, said that the machine was shipped by his clients in April, 1922, at Tilbury. The stator weighed 25 tons 9 cwt., and the ship issued a bill of lading deliverable to the plaintiffs. In the act of discharging the machine at Madras, the package fell overboard to the bottom of the harbour. It was eventually recovered by a diver, but not before it had been very seriously damaged. It was rendered useless, and had to be re-conditioned completely. The salt water had set up rusting which made the reconditioning necessary before the machine could be useful at all. In respect of the damage sustained the plaintiffs claimed about £5,756.

The points of the defence put in referred to the terms of the contract based on the terms of the bill of lading. According to the pleadings the damage was caused by the breaking of the derrick guy rope. Defendants contended that a latent defect in the tackle, which came within the exceptions of the bill of lading, had caused the damage.

The hearing was adjourned until July 5th, to give plaintiffs an opportunity of calling evidence from India.

THE NORTH-EAST MIDLANDS ELECTRICITY DISTRICT.

Electricity Commissioners' Decisions.

The Electricity Commissioners have considered the evidence given at the inquiry held at Sheffield in October and December last into the scheme submitted by the Corporation of Sheffield, for the establishment of a Joint Electricity Authority for the above-mentioned district, and they have decided that the area provisionally determined is confirmed subject to (*a*) the *exclusion* of the municipal borough of Buxton and the parishes of Chapel-en-le-Frith, Fernilee, Green Fairfield, Hartington-Upper-Quarter, King Sterndale, and Peak Forest and the townships of Chinley, Bugsworth and Brownside, and Wormley in the rural district of Chapel-en-le-Frith, all of which have since been included within the South-East Lancashire Electricity District; (*b*) the *exclusion* of the urban districts of Bolton-upon-Dearne, Hoyland Nether, Thurnscoe, and Wath-upon-Dearne, all of which will be included in the West Riding (Aire and Calder) Electricity District; (*c*) the *exclusion* of the urban district of Barton-upon-Humber.

Although evidence was given at the inquiry to show that the proposed scheme of development offered no immediate advantages to those parts of Lindsey, in the county of Lincoln, which are included in the provisionally determined district, the Commissioners have come to the conclusion that those parts of Lindsey should be associated, from the outset, with the development of the other portions of the district.

During the inquiry representations were made by the promoters of the scheme that the portions of the areas of supply of (*a*) the Yorkshire Electric Power Co., and (*b*) the Derbyshire & Nottinghamshire Electric Power Co. situated within the district should be excluded, in virtue of the provisions of Section 17 of the Electricity (Supply) Act, 1922, from the authorised areas of supply of those companies, but the Commissioners are of the opinion that the Yorkshire Co. should

continue to operate within its statutory area in the North-East Midlands District. With regard to the Derbyshire Co., which has not hitherto supplied electricity in the district, the Commissioners are not satisfied that a case has been made out for recourse to the provisions of Section 17 of the Electricity (Supply) Act, 1922, and they are of the opinion that the company should be afforded the opportunity of developing its area and that any question as to exclusion under that section should be left for future considération.

The technical scheme submitted by the Corporation of Sheffield provided for the interconnection of the municipal generating stations in the district; for the installation of additional generating plant therein amounting to 20,000 kW to meet the estimated growth of load (exclusive of railway and colliery demands) during the next four or five years; for the subsequent extension of the municipal stations at Sheffield (Blackburn Meadows) and Rotherham; and for the establishment when required of two further generating stations on the River Don at Mexborough and Sprotborough respectively. It was also proposed to construct transmission lines during the first stage of development to connect Sheffield, Rotherham, Mexborough, and Doncaster; Sheffield, Dronfield, and Chesterfield; and Rotherham, Beighton, and Worksop; and at a subsequent stage to connect Chesterfield and Doncaster *via* Barlborough and Kiveton Park, but the Commissioners consider it would be premature to come to a conclusion whether the new capital station (or stations) ultimately required in the district should be situated on the River Don, and they are of the opinion that the possible alternative of a capital station on the River Trent, where more ample supplies of condensing water will be available, should be left open for further investigation at a later date.

With regard to the transmission system, it appears to the Commissioners that advantages would accrue if arrangements were made (*a*) with the Yorkshire Co. for the erection of some of the proposed lines by that company, and (*b*) with the various colliery owners for the connection (where practicable) of their electrical systems with the main transmission system of the district.

Subject to the foregoing observations, the Commissioners approve generally of the technical proposals submitted to them. They are of the opinion, however, that a further improvement could be effected with regard to the distribution of electricity in the area to the south of Sheffield, and that this matter could be satisfactorily settled by arrangement between the Corporation of Sheffield and the Derbyshire Co. A case has been made out for the establishment of a Joint Authority on the lines proposed by the Sheffield Corporation, but the approval of the Commissioners to its establishment is conditional upon the transfer or lease to that Authority of the stations within the district belonging to the principal authorised undertakers, or upon the agreement of those undertakers to an effective and unified control by the Authority of the stations. The appropriate constitution for the Joint Authority presents some difficulties, and in the opinion of the Commissioners the schemes of representation discussed at the inquiry do not adequately meet the situation. They have come to the conclusion that a constitution as indicated below, providing substantial representation of the Corporations of Sheffield and Rotherham, should prove appropriate, subject to provision being made for the future representation of any authorised undertakers hereafter established in the district: City of Sheffield, 8; County Borough of Rotherham, 4; Borough of Chesterfield, 2; Borough of Doncaster, 2; Urban District of Mexborough, 1; Urban District of Worksop, 1; Local Authorities not supplying electricity (jointly), 2; Yorkshire Electric Power Co., 1; Derbyshire and Nottinghamshire Electric Power Co., 1; Sheffield and Rotherham Manufacturers (Electric Supply Committee), 1; the South Yorkshire Coal Trades Association, the Derbyshire & Nottinghamshire Coal Owners and Ironmasters' Committee, the Doncaster Collieries' Association, and the Lincolnshire Ironmasters' Association (by election), 1; London Midland and Scottish Railway, 1; London and North-Eastern Railway, 1; total, 26.

The Commissioners will prepare a draft Order giving effect to their decisions prior to the holding of the further local inquiry required by Section 5 (4) of the Electricity (Supply) Act, 1919.

A Radio Demonstration Van.—There is no more effective method of publicity for radio broadcast receivers than actual demonstrations with the sets, and those dealers who are alive to this fact are arranging suitable demonstrations whenever an opportunity offers. In some cases it is difficult to obtain suitable premises for demonstrations, but Messrs. Wireless Service, Ltd. (in association with Electrical Installations, Ltd.), have equipped a novel demonstration van, which consists of a touring motor-car, the body of which has been camouflaged to look like a small country cottage. A short but efficient aerial is erected on the roof, and the interior is equipped with a "Gecophone" two-valve receiving set and full equipment of loud speaker, &c. Some successful business tours in country districts within 100 miles of London have been made, and the demonstration van has given concerts in market places.

PLANNING, PROGRESS AND COSTING.

By FREDERICK W. POPE.

In a recent article on the subject of "The Relation of Lay-out to Costing" the writer introduced the question of works routine. To what extent it is necessary to adapt the works routine to the purposes of costing has now to be considered.

It has been proved that costing is very largely dependent upon a planning and progress system; dependent to this extent, that where such a system exists entries in the cost records are simplified, comparisons are more easily made, and a check is provided against careless time-recording.

The objection may be raised that planning is a luxury, only possible to wealthy firms, and this view is one which finds a good deal of support. Is the expense of inefficiency ever considered in the same light? It is all a matter of perspective, and the fact remains that efficient methods may be introduced into the factory on the ground of economy alone.

In the previous article we showed how simple are the beginnings of a planning system. The first thing necessary is the drawing up of a list of operations on each component; the next, that the order of them shall be arranged.

A progress system naturally follows, for the reason that the work cannot be left to take its own course through the shops.

What has all this to do with costing? The connection is best shown by illustration.

A stock order might be issued for the machining of a dozen shafts. The foreman puts this into operation by requisitioning the bar and getting a dozen lengths cut off—not two or three now, and the rest at any time. The lengths then go to the lathe for turning, and no other work must be allowed to interrupt them before they are finished. Other operations must be carried through in the same way, else what is the advantage of machining in sets?

The cost department benefits in several ways, some of which have already been referred to. Entries are simplified in that only one entry need be made for the time spent upon each operation, whereas, if the work is sent through in haphazard manner, the shafts might be set aside for other work several times and at any stage.

Even in the issuing of time-cards this difference would be noticed. Again, in designing cost record sheets, the works accountant will know how much space to allow for all the time spent upon each order.

In costing, say, an electric motor, the final cost sheet need not be larger than a double page of this paper, and for "machining orders" the sheet need only be quarto size. The unwieldy cost sheet is usually the result of a slack factory routine.

Previous articles have pointed out that timekeeping for costing purposes is, in many shops, entirely dependent upon the memory of workpeople. The turner setting up for a dozen shafts easily forgets that he has just finished one job and is commencing another. The result is that, until he remembers that he has not "clocked on," all his time is going down to the previous job.

That 100 per cent. efficiency is an impossible ideal in this regard must be admitted, but a reliable progress system will reduce the likelihood of oversight to practically *nil*. This point is of great importance and should be impressed strongly upon foremen and progress clerks.

It is hoped that the bare outline given here will prove that a costing system is not merely a matter of office routine, but is interdependent with every other function of the factory.

NEW PATENTS APPLIED FOR, 1923.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEPTON-JONES, O'DELL AND STEPHENS, Patent Agents, 285, High Holborn, London, W.C. 1.

11,559. "Magneto dynamos for motor vehicles." F. I. Hoffman. April 30th.
11,564. "Crystal detectors for wireless current." W. E. Poole. April 30th.
11,578. "Electric clocks." G. Broughall. April 30th.
11,580. "Device to be fixed to clocks for opening and closing an electric circuit." B. W. Hecht (S. Kaufman). April 30th.
11,583. "Electric couplings." D. Gibson & Co., Ltd., and E. Scott. April 30th.
11,585. "Cutting metals by electric carbon or oxy-acetylene processes." H. McKenzie. April 30th.
11,588. "Wireless systems." T. H. Kinman. April 30th.
11,594. "Electric luminous discharge lamps." General Electric Co., Ltd. April 30th. (Germany, January 20th.)
11,599. "Sparking plug." J. Dubail. April 30th.
11,610. "Electric, &c., fans." G. Clark and S. G. Leach. April 30th.
11,622 "Process for limiting intensity of current in electric circuit, &c." Soc. Anon. pour l'Equipement Electrique des Véhicules. April 30th. (France, June 14th, 1922.)
11,638. "Electrically-propelled vehicles." English Electric Co., Ltd., and E. S. Rayner. April 30th.
11,657. "Means for protection and functioning of thermionic valves, &c." Temple Cox Research Co., Ltd., and R. Temple. May 1st.
11,663. "Non-dazzle lamps for vehicles." F. A. Swaine. May 1st.
11,681. "Microphone relays, receivers, &c." A. S. Jones. May 1st.
11,682. "Loud speakers, receivers, &c." A. S. Jones. May 1st.
11,683. "Wireless direction-finding systems." J. Robinson. May 1st.
11,684. "Loud-speaking wireless sound-box." H. W. Pearce and J. F. Pollard. May 1st.
11,691. "Variometers, &c., for wireless receiving sets." W. H. Collins. May 1st.
11,699. "Terminal for electric apparatus, &c." Shaftesbury Wireless and Engineering Co., Ltd. May 1st.
11,701 "Arrangements for phase compensation and slip adjustment in asynchronous electric motors." W. E. M. Ayres and English Electric Co., Ltd. May 1st.
11,711. "Electric switches." C. C. Garrard, A. H. Railing and A. F. Searle. May 1st.
11,715. "Telephone systems." D. A. Christian and Siemens Bros. & Co., Ltd. May 1st.
11,716. "Telephone systems." W. G. Patterson and Siemens Bros. and Co., Ltd. May 1st.
11,722. "Loaded signalling conductors." Western Electric Co., Ltd. May 1st. (United States, May 2nd, 1922.)
11,747. "Electro-magnetic relays, &c." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.). May 1st.
11,748. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. May 1st. (United States, July 6th, 1922.)
11,756. "Electrically-driven vehicles." W. H. Heise and J. Schurch. May 1st.
11,786. "Filaments for electric lamps, &c." British Thomson-Houston Co., Ltd. (General Electric Co.). May 1st.
11,793. "Electro-magnetically-actuated acoustic diaphragms." G. B. Burnside. May 2nd.
11,795. "Inductance coils for wireless receiving sets, &c." C. E. Castellan and E. H. Chapman. May 2nd.
11,814. "Electrically-operated starting-gear of internal-combustion engines." H. W. Hutchinson and T. P. Rennoldson. May 2nd.
11,819. "Means for winding electric coils." P. A. McCarry. May 2nd.
11,827. "Loud speakers for wireless receiving installations." G. S. Wilson. May 2nd.
11,830. "Apparatus for electrically translating sound waves into light waves and for producing a photographic record of such waves." T. W. Case. May 2nd.
11,831. "Apparatus for electrically translating sound waves into light waves and for producing a photographic record of such waves." T. W. Case. May 2nd.
11,832. "Apparatus for electrically translating sound waves into light waves and for producing a photographic record of such waves." T. W. Case. May 2nd.
11,836. "Lead-in wires for wireless, &c., apparatus." R. C. Watkins. May 2nd.
11,837. "Thermionic valves." A. P. Portway. May 2nd.
11,842. "Connecting devices for electric conductors." H. N. Smith. May 2nd.
11,843. "Receiving circuits for wireless telegraphy, &c." D. Grimes. May 2nd. (United States, September 19th, 1922.)
11,864. "Means for connecting wires to terminals, &c." R. H. Rice. May 2nd.
11,865. "Crystal detector." T. F. Gaynor and E. S. Johnson. May 2nd.
11,869. "Loud speakers." L. Lumiere. May 2nd.
11,870. "Outdoor aerial wires for wireless telephones." R. O. McGown. May 2nd.
11,874. "Electric motor controllers." A. H. Curtis, Igranic Electric Co., Ltd., and A. H. Mackley. May 2nd.
11,876. "Thermionic valves." A. W. Coates and A. Southgate. May 2nd.
11,878. "Electric advertising devices, &c." H. S. Coleman. May 2nd.
11,881. "Panel boards for wireless apparatus." R. E. Beswick, R. Ferguson, and Radio Communication Co., Ltd. May 2nd.
11,896. "Electric circuit-connecting devices." A. J. P. McCarthy. May 2nd.
11,897. "Insulation of electric conductors." H. K. Whitehorn. May 2nd.
11,901. "Filaments for electric lamps, &c." British Thomson-Houston Co., Ltd. (General Electric Co.). May 2nd.
11,914. "Electric lamp holder and shade." J. Knight. May 3rd.
11,924. "Trolley-heads of electric tramcars, &c." A. T. Harrop. May 3rd.
11,925. "Trolley-heads of electric tramcars, &c." A. T. Harrop. May 3rd.
11,930. "Electric lamp shades." H. J. Johnson and J. H. Jones. May 3rd.
11,947. "Device for preventing infection from telephone mouthpieces." F. Ashworth. May 3rd.
11,952. "Apparatus for producing rhythmical variations of intensity in a constant current of electricity." F. Horridge. May 3rd.
11,957. "Insulators." W. J. Polyblank. May 3rd.
11,961. "Control of electrically-propelled road vehicles." A. E. Collins and R. Garrett & Sons, Ltd. May 3rd.
11,964. "Automatic cut-out for electric boiling vessels." P. R. Clark, P. Clark & Co., E. E. Edwards, and G. G. Koop. May 3rd.
11,979. "Charging electric accumulators, &c." J. H. Runbaken and W. Torrance. May 3rd.
11,982. "Interlocking devices for controlling electric circuits." G. W. Hale and Wireless Equipment, Ltd. May 3rd.
11,986. "Transmission or reproduction of sound." Electric Productions Co., Ltd. May 3rd.
11,988. "Electric furnaces." C. R. Hodgson. May 3rd.
12,011. "Manufacture of inductance coils for wireless telegraphy, &c." F. Akister. May 4th.
12,015. "Trucks for tramway vehicles." E. A. Walsh and E. Y. Walsh. May 4th.
12,020. "Tumbler switch attachment." J. A. G. Harrisson. May 4th.
12,028. "Electric liquid-heaters." E. Jost. May 4th.
12,029. "Electric switch plates." A. E. Millard, A. E. Read, and Walsall Hardware Manufacturing Co., Ltd. May 4th.
12,032. "Electric couplings." J. H. Bradley. May 4th.
12,034. "Time switches and signalling devices." H. B. C. Pollard. May 4th.
12,042. "Telephone receivers." E. D. Young. May 4th.
12,046. "Wireless crystal holders." G. Edwards. May 4th.
12,051. "Wireless receiving apparatus." J. S. Jayes and R. W. R. Phillips. May 4th.
12,064. "Electric switches." P. R. Coursey and Dubilier Condenser Co. (1921), Ltd. May 4th.
12,080. "Dynamo-electric machines." E. Graichen. May 4th. (Germany, May 4th, 1922.)
12,124. "Head-bands for telephones." H. Bertelsen. May 5th.
12,128. "Electric fire-bars, &c." Falkirk Iron Co., Ltd., and A. R. Wood. May 5th.
12,132. "Wireless receiving apparatus." A. Ford-Lloyd and A. Stagg. May 5th.
12,150. "Train control." A. R. Angus. May 5th.
12,151. "Electric time-element devices." F. N. Linstow and A. Reyrolle and Co., Ltd. May 5th.
12,159. "Electric modulating apparatus." A. F. Sykes. May 5th.
12,160. "Electric fuse, &c., fittings." H. W. Breeze and W. T. Henley's Telegraph Works Co., Ltd. May 5th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1921.

23,138. "Electric motor and like controllers." C. J. Gardon. June 30th. 1922. (196,304.)
26,932. "Electric relays and the like." British Thomson-Houston Co., Ltd., and A. S. Fitzgerald. October 11th, 1921. (196,305.)
27,599. "Suspension of incandescent filaments in thermionic valves and the like." S. R. Mullard and Mullard Radio Valve Co., Ltd. October 18th, 1921. (196,308.)
27,608. "Lock-nut device for tramcar brake mechanism." J. Brown. October 18th, 1921. (Cognate application 6,804/22.) (196,309.)
27,896. "Process for determining the exact position of losses in electric cables or lines." W. A. Luth. October 20th, 1921. (196,311.)
28,350. "Apparatus for electrically enabling bodies to follow a marked-out route." A. W. Loth. October 25th, 1921. (Patent of addition not granted.) (196,633.)
31,169. "Electric cookers and electric radiators." E. Schattner and I. S. Dalgleish. November 22nd, 1921. (Cognate application 14,502/22.) (196,319.)
31,544. "Electric arc welding applicable for welding studs, tubes, or the like to or into metal plates, bodies, and the like." L. J. Steele, H. Martin, and A. E. McCarthy. November 24th, 1921. (196,323.)
34,188. "Electric switches." J. A. Crabtree. December 20th, 1921. (196,330.)
34,503. "Electrolytic iron." F. A. Eustis. December 22nd, 1921. (196,334.)

1922.

1,605. "Reflectors for use with motor vehicle head-lamps and the like." Dr. W. R. Walkey and A. F. Bargate. January 18th, 1922. (196,354.)
1,609. "Bulb reflector and globe fittings of electric lanterns and the like." Veritys, Ltd., and F. W. Thorpe. January 19th, 1922. (196,355.)
1,666. "Electric relays and the like." W. S. Graff-Baker. January 19th, 1922. (196,362.)
1,769. "Potential transformers and fuses used in connection therewith." W. A. Coates, D. R. Davies, and Metropolitan-Vickers Electrical Co., Ltd. January 20th, 1922. (196,369.)
1,793. "Electron discharge devices and methods of operating the same." British Thomson-Houston Co., Ltd. July 1st, 1921. (182,431.)
1,875. "Electromotive apparatus for track circuit relays or electricity meters." General Electric Co., Ltd., A. E. Angold, and F. L. Castle. January 21st, 1922. (196,375.)
2,261. "Alternating-current electric motors." L. H. A. Carr and Metropolitan-Vickers Electrical Co., Ltd. January 25th, 1922. (196,391.)
2,280. "Diaphragms for gramophone reproducers, telephone receivers, and like sound-reproducing devices." E. A. Graham. January 25th, 1922. (196,392.)
2,967. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. February 19th, 1921. (175,611.)
2,990. "Safety devices for winding or hoisting apparatus." C. E. Raeburn, W. E. Taylor, and Metropolitan-Vickers Electrical Co., Ltd. February 1st, 1922. (196,411.)
4,332. "Electric current controllers and the like." British Thomson-Houston Co., Ltd., and C. T. Hanna. February 14th, 1922. (196,430.)
7,753. "Transformers for wireless circuits." A. P. Welch. March 16th, 1922. (196,453.)
8,245. "Magneto-electric ignition apparatus for internal-combustion engines." Scintilla (firm of). April 29th, 1921. (Addition to 120,981.) (179,147.)
8,597. "Loaded transmission lines for use in telephone systems or the like." Western Electric Co., Ltd. June 4th, 1921. (181,328.)
8,786. "High-vacuum pumps of the aspirator type." Western Electric Co., Ltd. June 20th, 1921. (182,090.)
8,917. "Electric signalling system for railways." G. C. Reed. March 28th, 1922. (196,461.)
10,886. "Selecting devices for telephone systems." C. Rockley. April 18th, 1922. (196,473.)
12,176. "Electrical resistance grids." R. F. Baerlocher. May 1st, 1922. (196,480.)
13,811. "Leading-in conductors for vitreous material." Naamlooze Vennootschap Philips' Gloeilampenfabrieken G. Holst, and E. Oosterhuis. May 16th, 1922. (196,497.)
15,805. "Electrolytic manufacture of metal articles, being replicas of natural or manufactured objects or articles." G. P. Tussaud. June 7th, 1922. (196,510.)
15,969. "Means for gripping electric cables to junction boxes or the like." Johnson & Phillips, Ltd., and C. J. H. Stevens. June 8th, 1922. (196,511.)
19,174. "Electrical and thermal insulators and process of manufacture thereof." A. A. Samuel. August 1st, 1921. (184,164.)
19,443. "Primary electric batteries." B. F. S. Baden-Powell. July 15th, 1922. (196,523.)
20,126. "Electrical measuring instruments." Metropolitan-Vickers Electrical Co., Ltd. (Westinghouse Electric and Manufacturing Co.). July 22nd, 1922. (196,525.)
20,458. "Arrangement for suspending overhead conductor wires on electric railways and the like." Sir P. Dawson and F. W. Fawdry. July 26th, 1922. (196,528.)
23,649. "Oil-supply systems." Metropolitan-Vickers Electrical Co., Ltd. September 30th, 1921. (186,593.)
28,062. "Fittings for electric candle lamps." M. J. Railing and J. H. Collings. October 16th, 1922. (196,543.)
28,209. "Controllers for electrical control systems." N. E. North and Metropolitan-Vickers Electrical Co., Ltd. April 18th, 1922. (Divided application on 187,038. Addition to 187,038.) (196,544.)

1923.

5,342. "Tool, battery, and like boxes for motor vehicles." Daimler-Motoren Ges. March 24th, 1922. (196,361.)